VOL. XXX NEW YORK—THURSDAY, MARCH 26, 1914—CHICAGO No. 13

The AUTOMOBILE

Aluminum—A Feather Weight

First Existed in 1845, Is Now Produced at Rate of More Than 70,000,000 Pounds a Year

By J. Edward Schipper

WHEN Napoleon III presented his son, the Dauphin of France, with an aluminum rattle, he gave him an object which at that time, 1856, was worth approximately $1,000. Today, if it were not for its historic value, the rattle could be purchased for 25 cents. The Napoleon rattle was one of the first objects to be made from aluminum which was then sold at $100 a pound in spite of the fact that it forms 8 per cent. of the earth's crust, as metallurgists today assert.

Aluminum is found everywhere. Common Portland cement is 5 per cent. aluminum, and in common earth aluminum is abundant, being in combination with silicates and other impurities. As a metal aluminum first existed in 1845, when the German chemist, Frederick Woehler, succeeded in separating it into a globular form. At the Paris show in 1878 it was sold in sheet, wire, foil and ingot forms at a price of $16 per pound.

First manufactured commercially 1889
Forms 8 per cent. of earth's crust
Forms 5 per cent. Portland cement
Best ore is clay known as Bauxite
Is lightest metal in structural use
Strong as steel on a weight basis
Weighs three times as much as water
A cubic foot weighs but 166 pounds
Has tensile strength of 26,800 pounds
Melts at a temperature of 657 Cent.
Weight used in 1913, 70,000,000 pounds
Is manufactured electro-chemically
Average automobile uses 70 pounds
Can be cast, drawn, spun or rolled
Average cost is 20 cents per pound
Combines readily with most metals
Copper and zinc most common alloys

Its Early Manufacture

In 1884, Charles M. Hall, then a student in Oberlin University, discovered a method of electrically extracting aluminum from the ores in which it is mingled with various impurities. This discovery worked out so well that in 1889 the Pittsburgh Reduction Co. was organized and put out a product that was over 98 per cent. pure aluminum at a price of 65 cents a pound. At that time three men were employed in the company and the output for the year for the entire aluminum industry was 47,468 pounds. In 1913 the company founded by Mr. Hall employed 5,000 men and produced the greater part of the 70,000,000 pounds manufactured in the United States. His company was then and is still known as the Aluminum Co. of America. The aluminum now produced is more than 99 per cent. pure.

Aluminum is the lightest commercial metal. It is three times as heavy, volume for volume, as distilled water, and as compared to gold, the heaviest metal, aluminum is about ⅛ its weight. A cubic foot of gold weighs 1,200 pounds, a cubic foot of aluminum, 166 pounds, and a cubic foot of water, 62.5 pounds.

The Lightest Metal

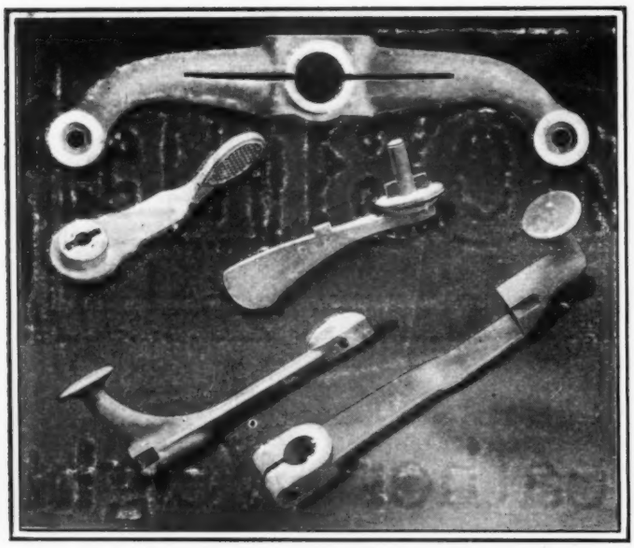
Lead, the heaviest commercial metal used in large quantities, weighs 709 pounds per cubic foot. Iridium, the heaviest of all metals, weighs 1,396 pounds to the cubic foot, and is more than eight times as heavy as aluminum.

Although the feather metal, aluminum has certain alloys which are even lighter than pure aluminum. When combined with magnesium, which weighs but two-thirds the amount of aluminum, an alloy called by the trade name magnalium is formed which weighs but .8 as much as aluminum.

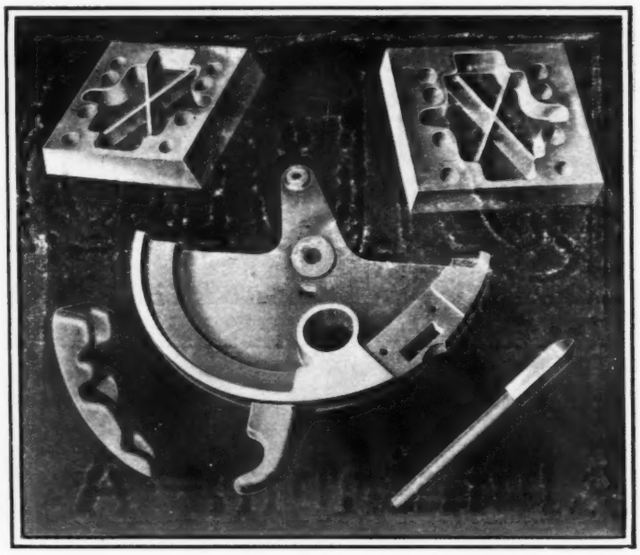
Considering its lightness it would be thought that aluminum would be at the foot of the list as regards strength, but this is not true. When measured pound for pound it is as strong as the mild steel used for structural purposes, and on an area basis it has a tensile strength, in ingot form, of 26,800 pounds to the square inch, as compared with 60,000 pounds for mild steel, 24,000 for cast iron, 26,000 for bronze, and 115,000 pounds for spring steel.

Aluminum melts at 657 degrees centigrade, silver at 961, copper at 1,084, cast iron at 1,050, and mild steel at 1,475.

Aluminum expands .0000231 foot for every foot of its length for each degree increase in temperature, and it is this factor that has rendered its use for pistons so difficult, because the coefficient of cast iron is but .0000121. With alumi-



Aluminum parts used on automobile steering wheel. These parts are light yet strong enough for the purpose



Aluminum die castings. Note square hole which eliminates broaching by using die casting process

num pistons it is necessary to leave a much greater amount of clearance between the piston and the cylinder.

A Good Heat Conductor

Aluminum is a good conductor of heat, carrying away about three times the quantity of iron and a third as much as silver, which is the best conductor. It weighs 2.56 times as much as distilled water, one-third as much as iron, and in its commonest alloy, No. 12, it has a specific gravity of 2.82.

The principal aluminum producing countries are the United States, France, United Kingdom, Italy and India. The best ore is known as Bauxite, so called from Les Baux, a city in France, where it was first found in abundance.

In the United States the principal mines are in Arkansas, Tennessee, Georgia and Alabama. Bauxite, mined in Arkansas, contains about 25 per cent. aluminum. While in the ore it is in the form of aluminum oxide

In 1908 France was the leader in Bauxite production with 167,991 tons, as compared with 56,127 tons in the United States, and with Great Britain, Italy and India, the other producing countries, not reaching 12,000 tons each. The following year saw the United States take the lead in the production with 129,101 tons to France's 128,099 tons. Since then the United States has increased from 129,000 to 148,000 in 1910, and 153,000 in 1911. The figures are not yet available for 1912 and 1913, but they will doubtless show a steady increase for the United States. These fixures on Bauxite only become interpreted when it is remembered that approximately 20 per cent. of this weight of ore becomes metallic aluminum.

Bauxite Found as Clay

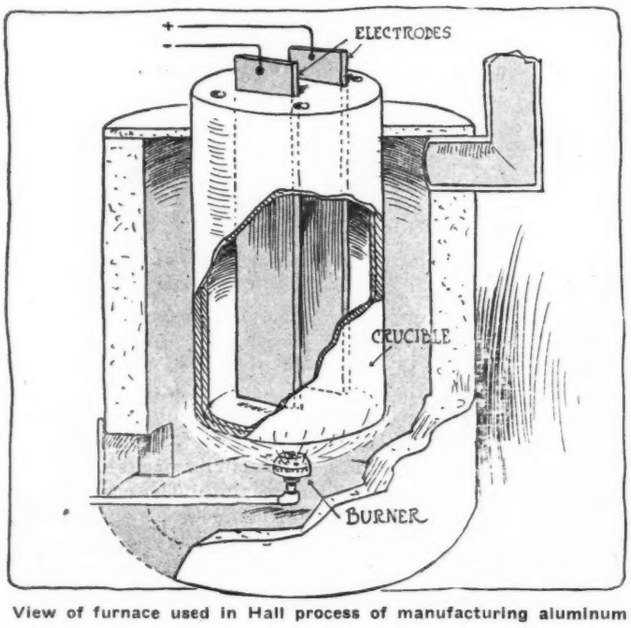
The commercial ore, Bauxite, is found as a reddish clay on the earth's surface the same as brick clay. The ore is loosened by black powder blasting and is carried from the mine in small narrow-gauge cars to the nearest railway siding. The ore is not washed, but carried in its natural state from the railroad cars directly into the crushers. It is then kiln-dried under 150 pounds air pressure and, in recent years, by means of natural gas as a fuel.

For the manufacture of metallic aluminum the ores containing most iron are selected. These are sent to the reduction plant, where they are submitted to the process of extracting the metallic aluminum.

The process used commercially in this country is that invented by Charles M. Hall, of the Aluminum Co. of America, which has immense plants at Niagara Falls and other cities. As the process is an electro-chemical one, the power of the falls is used to furnish the electro-motive force.

Description of the Hall Process

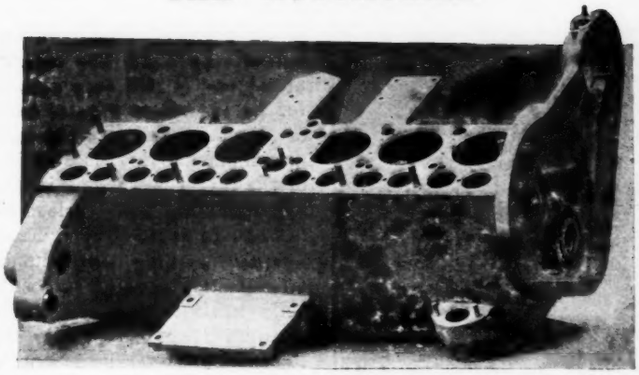
The principle used for extracting aluminum by the Hall process is the electrolysis of the molten mass of alumina, or oxide of aluminum. The apparatus consists of a furnace for keeping the alumina in a molten state, a crucible for holding the alumina and negative and positive electrodes. By the addition to the alumina of aluminum-sodium double fluoride, the molten mass is transformed into a conductor of electricity, or an electrolyte. When a current of electricity is passed through the electrolyte between the negative and positive electrodes, the electrolyte is decomposed and one of the resulting products is aluminum, which drops to the bottom of the vessel.



View of furnace used in Hall process of manufacturing aluminum

The illustration on page 674 shows diagrammatically the Hall process. The flame beneath the vessel maintains the alumina and the fluoride which has been added to it in a molten state. A current of

electricity passing between the electrodes decomposes the mass and the metallic aluminum falls to the bottom, from which point it is drawn off. The vessel which contains the electrolyte is protected against corrosion by lining it with carbon.



Six-cylinder crankcase cast from aluminum

In 1913 there were 70,000,000 pounds of metallic aluminum produced in the United States. In 1883 the output was 83 pounds. The 1,000,000-pound mark was passed in 1896, during which year 1,300,000 pounds were produced. During the following year, 1907, the production rose to 4,000,000 pounds. Since then it has risen rapidly, remaining stationary during 1900 and 1901, when the production was 7,150,000 pounds. From 1883 to 1913, inclusive, the production has totaled 375,358,779 pounds.

Aluminum can be used in many different forms. It can be cast for such work as crankcases, gearcase covers, etc. It can be die cast under pressure to make such forms as crankcase, differential case, gearbox, magneto bases, spark and throttle levers and many other small parts. It can be rolled into thin sheets and in this form is useful for the manufacture of automobile bodies, running boards, foot plates, etc., or it may be drawn into wire in the same way as gold, silver, copper, steel, etc., and can also be spun in the same way as copper or brass, making desirable utensils for cooking, etc.

Automobile Work 90 Per Cent. Castings

In the automobile industry aluminum has an extensive use, about 90 per cent. being in the form of castings. The other 10 per cent. is in sheet form or in small quantities in the bar. Taking one make of car for example, thirty-five parts are of aluminum. Of this number thirty are castings, four are of sheet aluminum, and one in bar form. This company during the year of 1913 used 203,000 pounds of aluminum and has been using this metal since 1902. The same parts approximately for which aluminum was used at that time are composed of it now. The biggest aluminum pieces in the car are the crankcase, gearset housing, rear axle housing cover, universal joint covers, fan, cowl, oil pan, bonnet sides, and the various caps and housings throughout the assembly.

The big production companies require an enormous amount of aluminum, the Overland company requiring alone 3,500,000 pounds annually; Jeffery, 1,000,000; Locomobile, 200,000, and the Haynes, Winton, Franklin, Peerless and Mitchell use about 300,000 pounds each. These companies generally use a copper alloy and employ it for any part where lightness is desired and where the strength is sufficient to fulfill the needs with a good margin of safety. For housings, brackets, piping, pumps, etc., it has met with practically universal favor. Alloys of this metal are used for pistons, and in our races of recent years these have met with an amount of success that justifies further experimentation in their use. Magnalium and McAdamite are two alloys which combine the light qualities of aluminum with an amazing strength and which have been suggested for pistons.

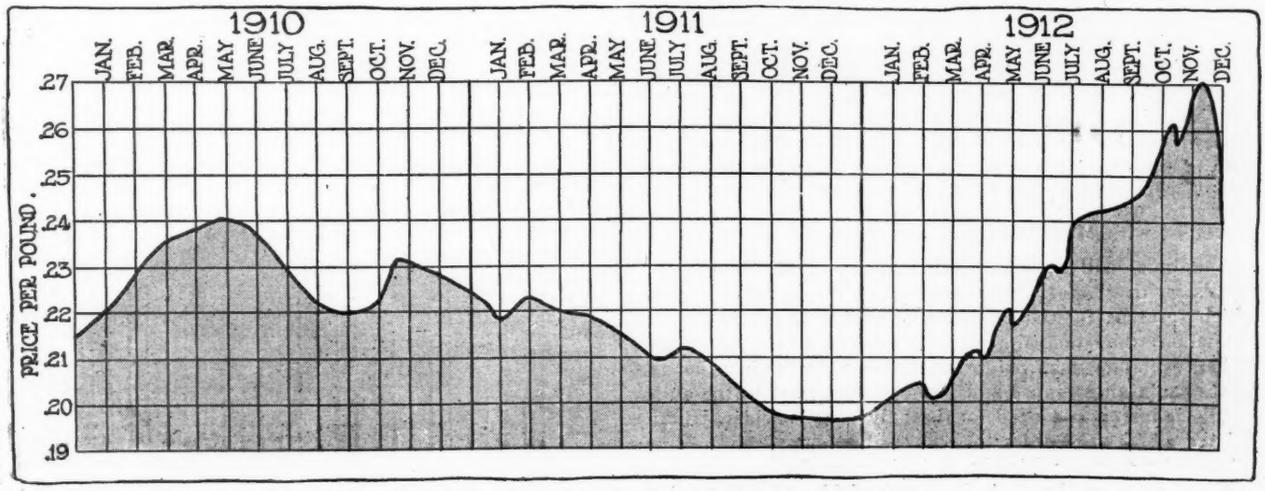
Aluminum is a difficult metal to handle for those who have not by experience mastered its many phases. For instance, a difference of 50 degrees Fahrenheit in the pouring temperature of the metal will change the tensile strength of the resulting casting by 500 pounds to the square inch. Many other difficulties enter into the casting of aluminum, not the least of which is the shrinkage, which amounts to .203 inch to the foot on pure aluminum and on the casting alloys generally used to .156 inch to the foot. Cast iron has a shrinkage of .125 inch per foot.

Machining Is Difficult

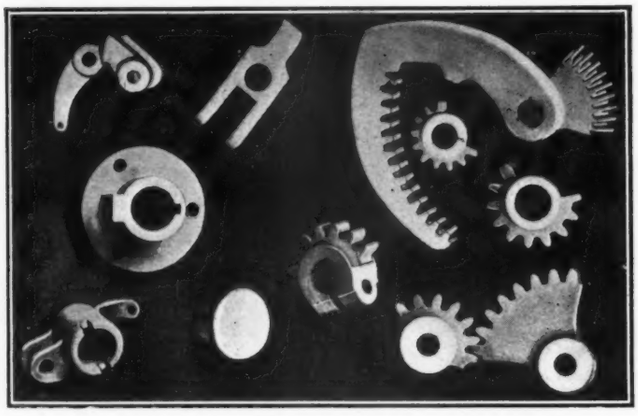
The machining of aluminum is difficult. It is a great tool heater, and in that way very much resembles copper. The work has to be carried on under a constant stream of cooling or lubricating agent, the most popular of which are a mixture of lard oil and water, or kerosene.

The cost of aluminum castings is little if any more than that of iron castings. While in the raw casting the iron one will be cheaper, but the handling of the aluminum through the shop is cheaper than iron. It is cheaper than bronze, piece for piece, and when the weight is taken into consideration, the adaptability to casting, rolling or spinning more than compensates for the difference in price.

About 80 per cent. of the cars made by American manu-



How the price of aluminum fluctuated in 1910, 1911 and 1912



Die cast aluminum parts, showing gear teeth and brake clevis

facturers have aluminum crankcases and about the same proportion holds true for gearcases. The demand is increasing and it is now being used in many small parts such as the connecting links for brake systems, spark and throttle connections, etc.

Aluminum die castings are now on a sound commercial basis. The Doehler Die Casting Co., of Brooklyn, N. Y., is turning out more than 4,000 of the castings a day, 75 per cent. of them being used in the automobile industry. Spark and throttle levers, brake rod devices, magneto bases, etc., are die cast; they are shown in the illustrations on pages 674, 676 and 677.

Die-Casting Methods

In die casting the metal is pressed into the steel moulds under a pressure of about 400 pounds to the square inch. The dies are closed by means of levers and the cores can run in any direction. Holes which are absolutely square can be cast into the metal, whereas if machining were resorted to an expensive broaching process would be necessary. The average selling price of the small die casting used in the automobile industry, such as, for example, the base of a magneto, is about 20 cents. About $1,000 worth of aluminum die castings are turned out per day by the Doehler company. Of this amount the automobile industry takes $750 worth. Magneto base plates can be turned out at the rate of 500 per day. After casting they require no further machining and they are absolutely uniform.

The advantage of die casting is the ability to make finished shapes to within .005 inch and thereby to eliminate a large amount of machining. It is this ability to cut the machining cost which enables the die-casting process to compete with the sand casting.

Aluminum combines with iron impurities and offers difficulties in the way of die casting. This is due to the fact that aluminum has a marked affinity for iron, and as the dies are made of machinery steel, there is a tendency for the aluminum to cling to the die when carried at its full molten state, 1,200 degrees Fahrenheit.

Combined with Many Alloys

Aluminum will combine readily with any of the common metals, with the exception of lead. The principal alloys which form useful combinations with aluminum are copper, chromium, tungsten, titanium, molybdenum, zinc, bismuth, nickel, cadmium, magnesium, manganese, tin and antimony. Those containing copper and zinc are used most in the automobile industry and need be the only ones considered here. All the alloys are harder than pure aluminum.

The alloy most used in the United States for castings, etc., is that known as the S. A. E. standard No. 12. It consists of 92 per cent. aluminum and 8 per cent. copper. It machines very much like copper and, while harder than pure aluminum, is still very soft, and zinc alloys are substituted for its use where greater hardness is desired. The working of aluminum and zinc together, and in fact, the entire art of aluminum alloying, is still in its infancy, and the chemists of the concerns working in aluminum are all busily engaged experimenting with various combinations of copper or zinc in order to fit the varying needs of the manufacturers.

When working with aluminum the processes used with other metals must be forgotten. Two castings may look exactly alike to the eye, and yet one may have a tensile strength of 22,000 pounds and the other will have barely 15,000 pounds tensile strength. Aluminum will weld satisfactorily with the oxy-acetylene and the oxy-air processes, but to solder it requires considerable knowledge of its peculiarities. Many companies that are handling large quantities of aluminum daily state that it cannot be soldered. Others see no difficulty in doing the work. The requisites for a successful soldering operation are that the aluminum must be free from grease or other foreign matter and the solder must be correctly prepared or else some of its ingredients are sure to be burned. Most cases of failure in aluminum soldering, however, can be laid at the door of the operator. The part to be soldered is heated up to such a degree that a thin oxide is formed on the surface, and instead of soldering two pieces of aluminum together, the operator does nothing but solder

Properties of Aluminum

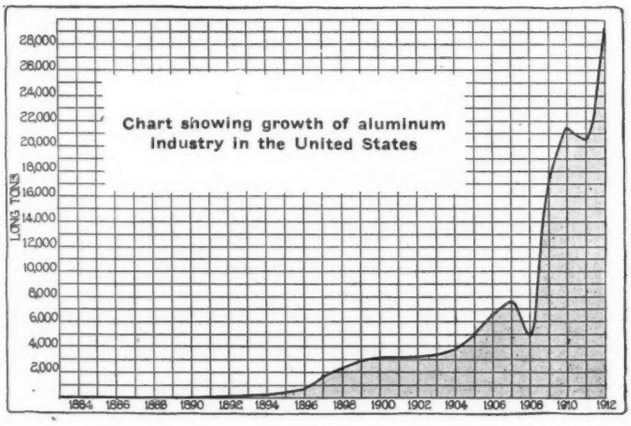
	Pounds
Elastic limit per sq. in. in tension (castings)	8,500
Elastic limit per sq. in. in tension (sheet)	12,500 to 25,000
Elastic limit per sq. in. in tension (wire)	16,000 to 33,000
Elastic limit per sq. in. in tension (bars)	14,000 to 23,000
Ultimate strength per sq. in. in tension (castings)	12,000 to 14,000
Ultimate strength per sq. in. in tension (sheet)	24,000 to 40,000
Ultimate strength per sq. in. in tension (wire)	25,000 to 55,000
Ultimate strength per sq. in. in tension (bars)	28,000 to 40,000
Per cent. of reduction of area in tension (castings)	15
Per cent. of reduction of area in tension (sheet)	20 to 30
Per cent. of reduction of area in tension (wire)	40 to 60
Per cent. of reduction of area in tension (bars)	30 to 40

Comparative Weight and Strength of Aluminum

	Weight of 1 cu. ft. in pounds	Tensile Strength per sq. in.	Length of a bar able to support its own wt. in ft.
Cast iron	444	16,500	5,341
Ordinary bronze	525	36,000	9,893
Wrought iron	480	50,000	15,000
Hard structural steel	490	78,000	23,040
Aluminum	168	26,800	23,040

Order of Ductility of Metals

1—Gold	4—Iron	7—Zinc
2—Silver	5—Copper	8—Tin
3—Platinum	6—Aluminum	9—Lead



the two thin pieces of aluminum oxide together, and at the slightest strain they part.

Exports $1,500,000 Annually

Aluminum forms one of the valued mineral resources of the United States and the exports now reach the value of $1,500,000 annually. This is nearly five times the value of the aluminum exports of 1907, when they were valued at $304,938. The increase has been a healthy, normal growth, and in no year has it dropped below the value of the preceding year. A chart of this growth in the exportation values is given on this page. The $1,000,000 mark was passed in 1911, when the value of the exports was $1,158,603. The importation of the metal is not increasing, owing to the low price at which it can be manufactured in this country and owing to the fact that the prevailing opinion is that the aluminum made in the United States is more than 1 per cent. less impure than the foreign. The duty of 3.5 cents per pound charged on aluminum in plates, sheets, bars, strips and rods acts as an added handicap to the foreign manufacturer. Unrefined Bauxite is on the tariff free list.

The rise and fall in the price of aluminum from month to month as shown in the price chart on page 675 is merely a question of supply and demand on the part of the maker and user after the ore leaves the mine, as there is no shortage of Bauxite in the producing mines now in operation.

Aluminum Prices Fluctuate

Since the first inception of aluminum the prices have undergone a marked change. The drop from 65 cents a pound in 1889 to 25 cents a pound 10 years later has put this metal well to the front as a material well justified by economy as well as by its physical properties. The fluctuation around the 25-cent mark has been great during the past few years, and a chart showing the rise and fall of the market value is given on page 675 for the years 1910, 1911 and 1912. In 1913 it averaged about 22 cents.

World's Production of Bauxite in Long Tons (2240 pounds)

	1908		1909		1910		1911	
C'ntry	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
United States.	56,127	$263,968	129,101	$679,447	148,932	$716,258	155,618	$750,649
France.	167,991	326,987	128,099	25,188	B	B	A	A
United Kingdom..	11,716	14,671	9,500	11,679	3,792	4,292	6,007	6,297
Indian..	A	A	32	58	66	122	A	A
Italy....	6,890	12,160	3,881	7,610	B	B	A	A

A—Production of 32 long tons value not available.
B—Statistics not available.

Production of Aluminum in the United States

Year	Pounds	Year	Pounds
1883	83	1898	5,200,000
1884	150	1899	6,500,000
1885	283	1900	7,150,000
1886	3,000	1901	7,150,000
1887	18,000	1902	7,300,000
1888	19,000	1903	7,500,000
1889	47,468	*1904	8,600,000
1890	61,281	*1905	11,347,000
1891	150,000	*1906	14,910,000
1892	259,885	*1907	17,211,000
1893	333,629	*1908	11,152,000
1894	550,000	*1909	34,210,000
1895	920,000	*1910	47,734,000
1896	1,300,000	*1911	46,125,000
1897	4,000,000	*1912	65,607,000
		*1913	70,000,000
Total			375,358,779

*Consumption.

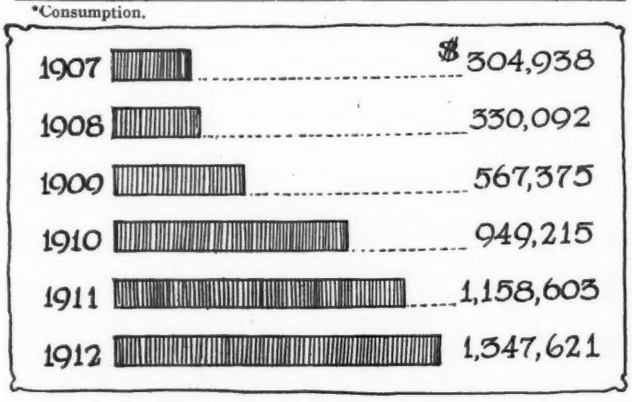
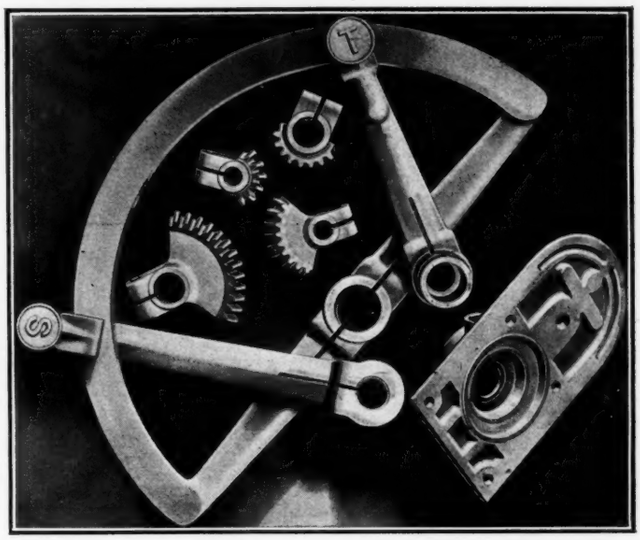


Chart showing aluminum exports since 1907



Magneto end plate and steering wheel connections die cast from aluminum

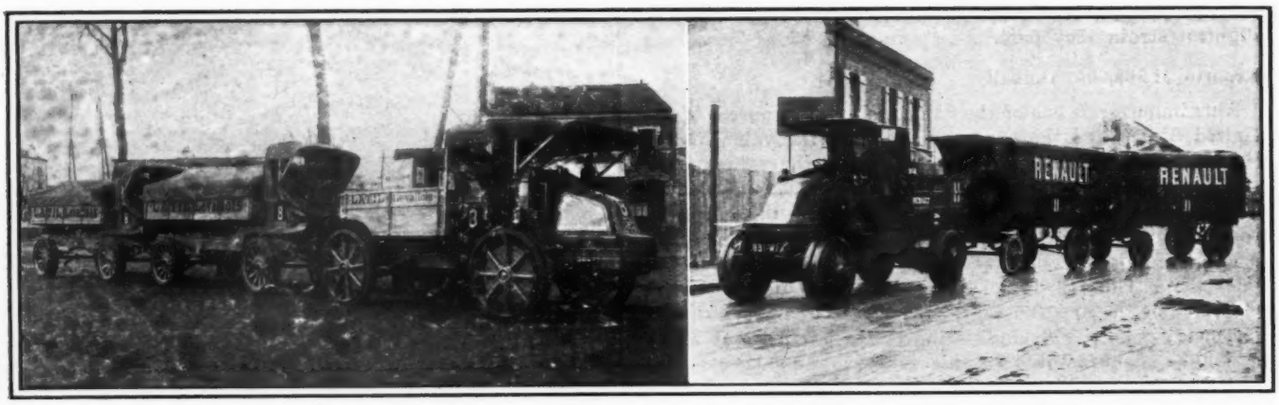
English and German Subsidy Trials

LONDON, March 13—The third British War Office subsidy trials are about to commence, in order that other builders of commercial motor vehicles can submit their machines for road tests and become subsidy vehicles. It was the intention of the War Office to build up a fleet of 1,000 subsidized vehicles to be available in cases of emergency, but at the time of writing there are only 400 available under the scheme and, if one can judge from appearances, it is not likely that this number will be increased on a larger scale than 200 per annum.

In Germany, where the subsidy scheme has been in operation for 5 years, there were no fewer than 825 commercial motors and trailers subsidized during that period. In Germany, as in England, a large development took place in the industrial motor industry during the time that this scheme has been in operation. In Germany after the subvention scheme six manufacturers were entitled to offer to their clients subsidy type vehicles. These were the N. A. G., Benz, Mercedes-Milnes-Daimler, Bussing, Mulag and Stower, and this year five other firms successfully passed through the trials and qualified for the same rights. These were the Namag, Podins, Naike, Durkopf and Eisenach, while at the present time there are fifteen firms who have qualified.

Germany Favors Subsidy Goods Carriers

The opinion has been expressed that subsidy vehicles do not form the best trade goods carriers by many in England, but this is not the view in Germany, as we find that 340 subsidy vehicles are employed by brewers, 192 for the transport of colonial goods, 66 for the conveyance of bricks, 53 carry the products of flour mills, 34 are engaged in agricultural work, 43 are employed in the building trade, 29 for iron and steel goods, 29 for stone and road making materials, and 17 for the delivery of coal and coke, 25 are used by delivery firms, 9 by paper makers, and 8 by printers, etc.



Left—Latil light tractor with trailers on rubber tires. Right—Renault type hauling two trailers

French Army Finds Four-Wheel Drive Tractors Most Efficient

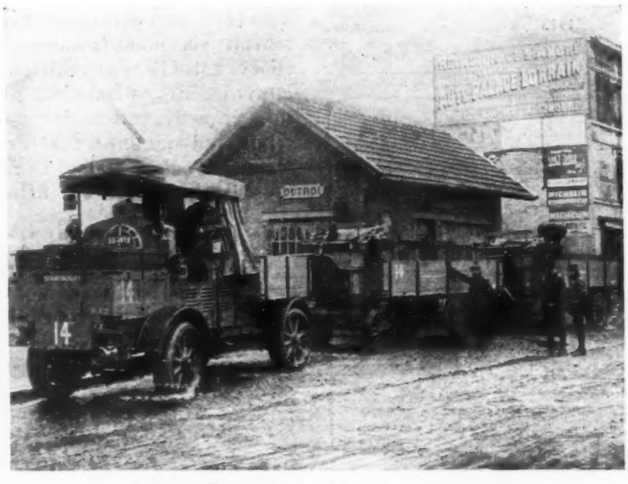
Requirements Call for Two Types, Light and Heavy—Four-Cylinder Motor, a Capstan and Solid Tires Obligatory

FOUR wheel drive tractors are considered by the French military authorities to be the most suitable type of vehicle for hauling heavy guns and ammunition wagons over ordinary roads and across country. This is an entirely new development of the power vehicle and one likely to have wide-reaching effects. It will not interfere with the present army transport organization, carried out largely by gasoline trucks, but it will be an entire revolution in the artillery service where horses have hitherto been supreme.

Efficiency Has Been Demonstrated

The experimental stage of the four-wheel drive tractor is passed. In private trials and during the annual maneuvers the authorities have become convinced of the efficiency of this class of vehicle. The competition, the first of its kind in the world, is being held to bring forth the best from the various factories. Sufficient is known of what can and what can not be expected of gasoline tractors working on roads and no roads for the army authorities to draw up a definite set of rules and requirements.

Two types of tractors are provided for, known respectively as light and heavy, towing dead weights of 8 and 10 tons minimum. A heavy tractor will weigh 5.5 tons and carry a useful load of 2 tons, making a total weight of 22.5 tons for the tractor and two trailers fully loaded. In the light class the tractor weight is 3.5 tons maximum with a useful load of 2 tons, and a weight of 8 tons for the two trailers, making a total of 13 5 tons for the three units fully loaded. The weight must be equally distributed over the vehicle, and no axle must carry more than 4.5 tons. A minimum clearance of 12 inches is required with the vehicle loaded. Platform bodies with movable sides are required for tractor and trailer in order to secure flexibility of arrangement.



Schneider tractor weighing in for the trials

Latitude in Design

A certain latitude is given in the general design of the vehicles. Four-cylinder motors are obligatory; there are restrictions with regard to the interchangeability of parts and particularly of magnetos. The carbureter must be capable of running with alcohol, benzol and gasoline. Cooling has to be sufficiently effective for the motor to develop its full power for 30 minutes while the vehicle is immobile. A winch or capstan must be fitted, together with the necessary amount of cable; there must be a flexible coupling at the rear and towing hooks both front and rear. Solid twin rubber tires are made obligatory on all four wheels, and there must be provision for attaching chains or other anti-skid devices around the tires. Tire widths are as follows:

WIDTH OF TIRE	MAXIMUM WEIGHTS
4.3 ins.....	1980 pounds
4.7 ins.....	2310 pounds
5.1 ins.....	2645 pounds
5.5 ins.....	2970 pounds
6.29 ins.....	3740 pounds

Fuel consumption, strength and accessibility of organs, ratio of useful load to total weight, speed and ease of operation, and particularly the ability to work under difficult conditions away from made roads will be the factors taken into consideration in making awards.

Six Tractors Entered

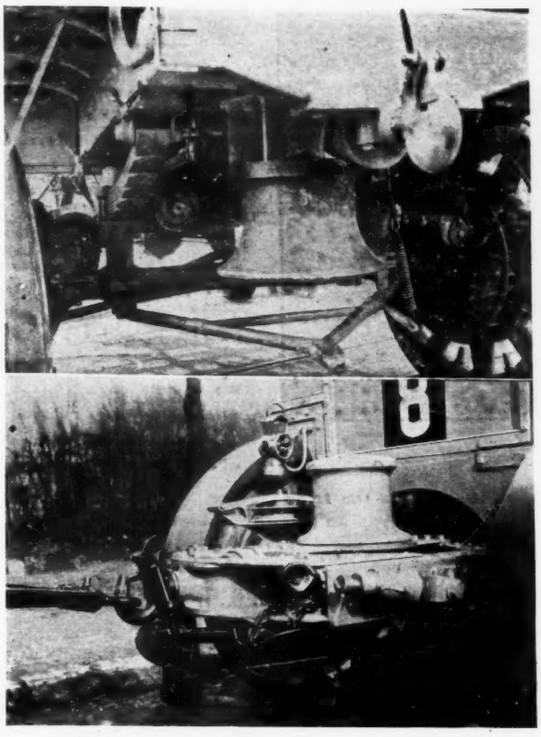
Six firms entered and four are taking part in the competition with six different types of vehicles. Panhard &

Levassor have entered two light and two heavy tractors; Latil has put in one light model and two heavy types; Renault and Schneider have each put in two heavy tractors. Each tractor hauls two trailers.

There are two distinct types of tractors: those having a single differential, this class comprising the four Panhard-Levassor machines, and those having a differential for each axle. In this category are Latil, Renault, and Schneider. Motor sizes are small in view of the heavy weight transported. In the heavy class where the total weight is 22.5 tons the bores and strokes are as follows:

TRACTOR	BORE	STROKE
Panhard & Levassor..	4.8	5.9
Latil	4.7	6.29
Renault	5.1	6.29
Schneider	4.8	5.5
Balachowsky & Caire*	4.7	9.8
Light tractors, total weight 13.5 tons:		
Panhard & Levassor...	3.9	5.5
Latil	3.7	5.5

*This tractor was built but did not start in competition.



Upper—Details of Panhard tractor. Note capstan under frame, spring mounting and worm drive

Lower—Rear of a Latil tractor, showing capstan, coupling, anchor and suspension

All the tractors have poppet valve motors with the exception of the two light-weight Panhard & Levassor, which are fitted with the Knight sleeve valve motor. This is the first occasion on which the French firm has made use of the Knight motor on a utility vehicle, although having had the license for this type for several years.

New Knight Model

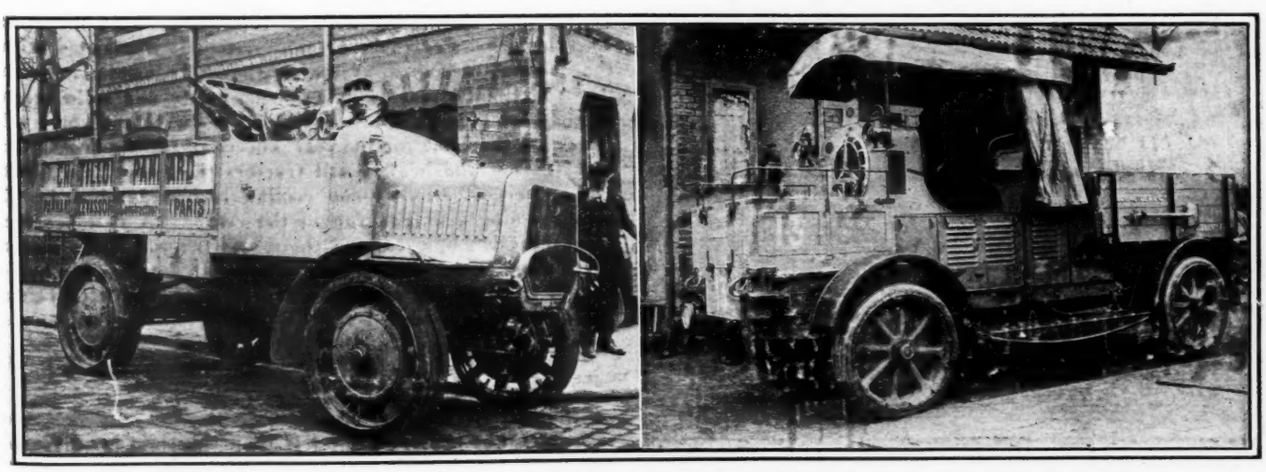
This tractor is an entirely new model appearing for the first time before the public in the army competition. Motor and gearbox form a single unit mounted directly to the frame members under a bonnet in front. Considerable care has been taken in the cooling arrangements, otherwise the design of the power plant is not special. The differential is independent of the power plant, being mounted practically midway between the two axles. From this central differential four shafts are carried diagonally to the road wheels, which they drive by means of worm gearing.

This is another Panhard innovation, all previous models having had bevel gearing or chain drive. In accordance with the army requirements, a lock is provided for the differential, and is controlled from the change speed sector. Cast steel wheels are fitted and are shod with twin rubber tires of 39 by 4.3 inches. On this tractor the capstan is at the rear and below the frame members. It is driven from the gearbox by shaft and worm gearing.

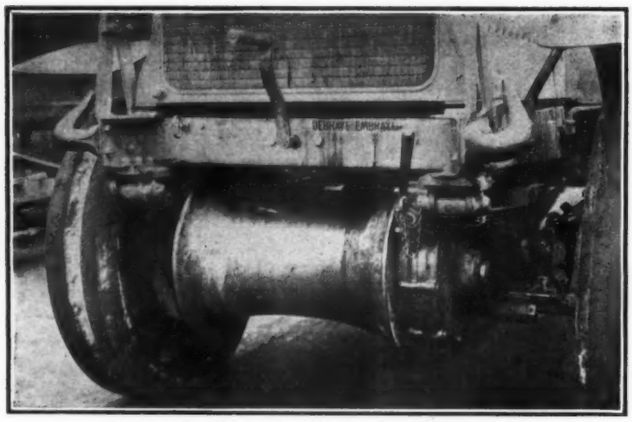
Gearset a Special Feature

The gearset on the small Panhard is rather a special feature, for it is really composed of a couple of four speed units united and provides 8 speeds and two reverses. Two of these speeds are considered as emergency gears and only used as such. The wheelbase of this tractor is 118 inches, with a tread of 60 inches.

The larger tractor is a type fairly well known to the French industry, for it has been in use for a couple of years and is already employed by the army. On this model a four cylinder separately cast poppet valve motor of 4.8 by 5.9 inches bore and stroke is made use of. In common with the smaller and newer model, there are no universal joints in the transmission, yet a complete relative movement is obtainable between the wheels and the chassis. The gearbox provides four speeds and reverse, but has nothing very distinctive in its design. As shown by the illustration on page 680, the primary shaft A drives the cross shaft G by means of the pair of bevel gears MN. The two halves of this cross shaft are united by the differential B. Each half of the cross shaft carries a bevel pinion engaging with the two pinions Q on the end of the propeller shafts D. These shafts are mounted within a torque tube E attached on the one hand to a housing on the rear axle and on the other secured by a spherical joint to the housing containing the driving pinions. The power is not transmitted direct from the propeller shafts to the road wheels, but passes through a pair of bevel gears R R, and the bevel gears S S to a vertical shaft in the vertical axis of the wheel. This shaft carries a bevel pinion engaging with a crown bevel wheel on



Left—Panhard light tractor with Knight motor and four-wheel drive. Right—Schneider, with central motor location



Winch on heavy Panhard tractor

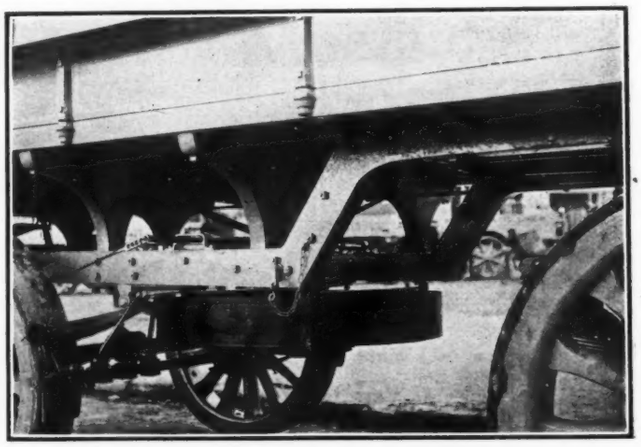
the hub of the road wheel. A winch is fitted across the front of this chassis, between the two frame members, and is driven by propeller shaft and worm gearing.

Renault Like Truck Design

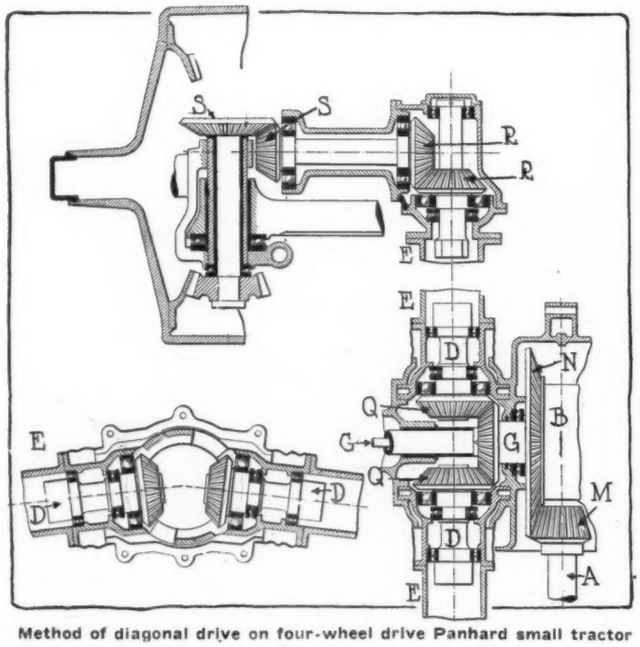
In the general design of his tractor Renault has adhered as closely as possible to the features of his ordinary trucks. The motor is of the same type and the axles are a modification of the live axle used on the ordinary vehicles. The motor is a four-cylinder in pairs, L-type, of 5.1 by 6.29 inches bore and stroke with thermo-syphon cooling, but with the addition of a belt driven fan on the dash to the rear of the radiator, in place of the flywheel fan on other models. This new fan is shut in by an aluminum housing on the dashboard, with a discharge for the air at the base of the housing. There are louvres in the bonnet so that the central tubes may secure the advantage of the current of air, and a guard at the back of the engine to direct this air onto the tubes and not on the cylinders.

The clutch is of the inverted cone type, and the coupling between clutch and gearbox is entirely enclosed by a two part housing, the lower half being an extension of the gearbox, and the upper half a detachable aluminum cover. The gearset, which is attached to the frame members by means of hangers, provides four speeds and reverse. It contains the usual primary and secondary shafts and a third shaft spur gear driven from the primary. It is from this shaft that the power is taken to the axles by universally jointed propeller shafts. One piece forged axles with a central cradle for the differential, are used, and are of the same general design as the axles of the ordinary vehicles. This cradle is covered by a cast steel housing on one side, carrying the driving pinion, and an aluminum cover on the opposite side.

In place of the usual drive shafts the tractor has universally jointed shafts, for the wheels are steerers as well as drivers. Steering gear is duplicated, the worm on the steering column engaging with a sector on a horizontal shaft set alongside the right-hand frame member. This shaft carries two worms engaging respectively with the sectors for front and rear wheels. From the drag links to the wheels the sets of levers are the same as on single steer vehicles. Renault's capstan is mounted on the rear cross frame members, behind the platform body, and is driven by shaft and worm gearing from the gearset. Springs are semi-elliptics all round, having the unusual width of 5.5 inches.



Latil trailer with spare wheel under frame



Method of diagonal drive on four-wheel drive Panhard small tractor

Latil Has Five-Speed Gearbox

Latil's tractors are the development of the front drive principle, of which this maker is the pioneer in France. The motor and gearbox form a unit set so far forward that the whole of the motor is ahead of the front axle. The drive is to a five-speed gearbox, and then by a universally jointed cross shaft to the rear wheels, the final transmission being by a spur pinion engaging with an internal gear on the road wheel drums. For the rear this system is duplicated with the absence, of course, of the gearbox. Transmission from the front to the rear is by propeller shaft and underneath worm gearing, but the differential, cross shafts and universal joints are the same for the rear wheels as for the front. On both the big and heavy Latil tractors the motor is a block casting with thermo-syphon cooling and a dashboard coil tube radiator having a fan in the center. A ball bearing crankshaft is employed, and the overall length of the motor is cut down to the lowest limits in order to decrease the overhang. Direct drive is on the fourth gear, the fifth being geared up and intended for use only when the tractor is running light.

Schneider Has Motor Amidship

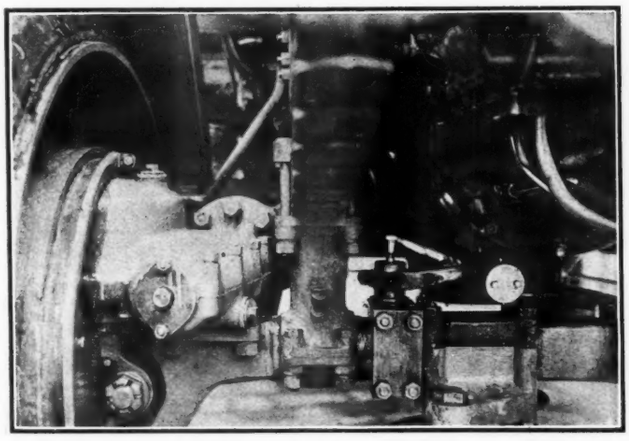
Schneider's tractor has its motor set midway between the two axles, but nearer to the left than the right-hand frame member. The driver's seat is above it and there is a plat-

form both to the front and the rear of the engine. The coil tube radiator is set high in order to assure the air reaching it when a load is carried on the front platform. From the gearset a propeller shaft runs to the front and the rear axles, both of which have differentials and universally jointed driveshafts operating spur gearing within the wheel drums in the same general way as on the Latil.

This competition takes consideration of all detail fitments of the tractor and trailers, and particularly the devices used for work across country. Cast steel wheels are used in every case; they are invariably fitted with twin rubber tires and have hooks on the inner face of the rim to which non-skid chains can be attached quickly and securely. Various types of chains have been designed by the makers of the tractors and will be put to a test in the cross country work. In addition to the chains, most of the makers have detachable ribbed steel rims—some makers have two sets—and have made provision for quickly attaching them to the road wheels when required. A differential lock is an obligatory feature on all vehicles. On the Panhard and the Renault tractors this lock is operated from the driver's seat; in other cases the driver has to leave his seat to put it into operation.

Capstans Are Obligatory

Capstans are another obligatory feature, but their detail designs vary. Latil, Renault and Schneider have mounted it on a stout metal platform at the rear of the chassis, back of the platform body. In the case of the Schneider four-gear

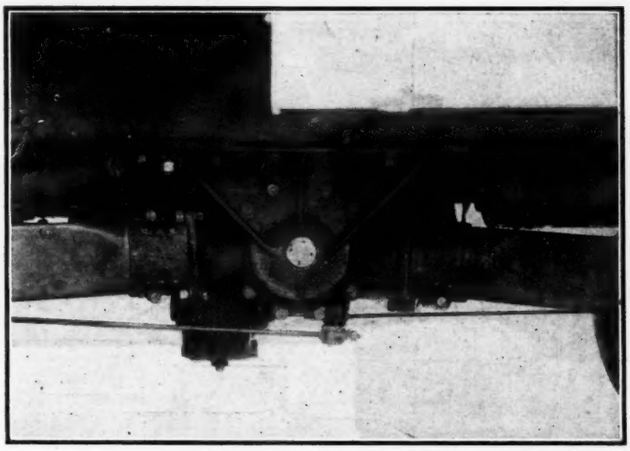


Details of worm drive, suspension and steering of Panhard. Note driveshaft is diagonal

ratios are provided, the speed of the cable being 11 inches, 23 inches, 39 inches and 70 inches a second. Manila cable is used with a diameter of 1.5 inches and a breaking strain of 9.5 tons. Latil has an arrangement whereby his cable can be brought forward, being guided around pulleys on the back and the side of the chassis, thus allowing an object to be hauled in front or in the rear. Another feature of the Latil is the use of a couple of anchors at the rear of the chassis. These are very stout metal struts having a universal joint attachment to the extremity of the frame members and broad ribbed feet to give them a firm hold in any kind of ground. These are in addition to the sprag, which must form a part of the equipment.

As an indication of the gear ratios generally adopted, the figures for the light Panhard-Levassor may be quoted. They are as follows: 2, 3, 4.5, 6.3, 9.8, and 15 miles an hour with the motor running at 1,000 revolutions. On ordinary roads an average minimum speed of 5 miles an hour is required to meet the army requirements.

Trailers are given attention in making awards. Practically all the makers have employed wood wheels with steel tires.



Exterior view of differential and diagonal shaft drive on Panhard tractor

Latil has the two trailers of his light tractor on rubber tires, and one of his trailers has a universally mounted front axle. A spare wheel is carried for the heavy trailers and is suitably mounted under the chassis. A spring coupling has to be fitted at the rear of each tractor so that the drive can be taken up without jerk, and towing hooks are placed on front and rear of each trailer. A central pole has to be carried so that in case of necessity horses can be hitched on to the trailers, or they can be moved about by hand.

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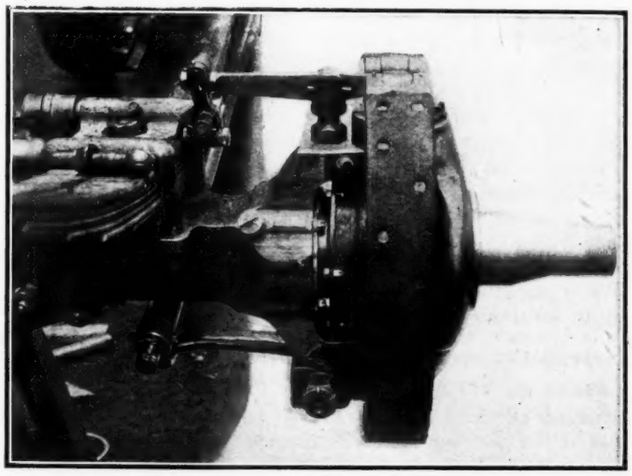
Montreal Has Over 3,000 Cars in Use

MONTREAL, QUE., March 20—One of the factors which helped to repudiate the persistent rumors of a trade depression and hard times in 1913 was the remarkable increase in the sales and general popularity of the motor driven vehicles in this city. The number registered up to the end of November, 1913, was 3,473. Of this number, however, 309 were registered by people living outside of Montreal, Island and adjacent municipalities, leaving 3,164 cars actually owned in greater Montreal in 1913—an increase of 877, or 38.3 per cent.

The actual number of owners of motor cars in Montreal has increased from 2,136 in 1913 to 2,982 in 1913—an increase of 846, or 39.6 per cent. The number of French Canadians owning cars has increased from 1,142 to 1,715, and English owned cars from 1,095 to 1,449. Of the 146 persons owning two cars or more 65 per cent., or 95, are English.



Renault four-wheel drive tractor with universal joint on driveshaft and details of brake mechanism

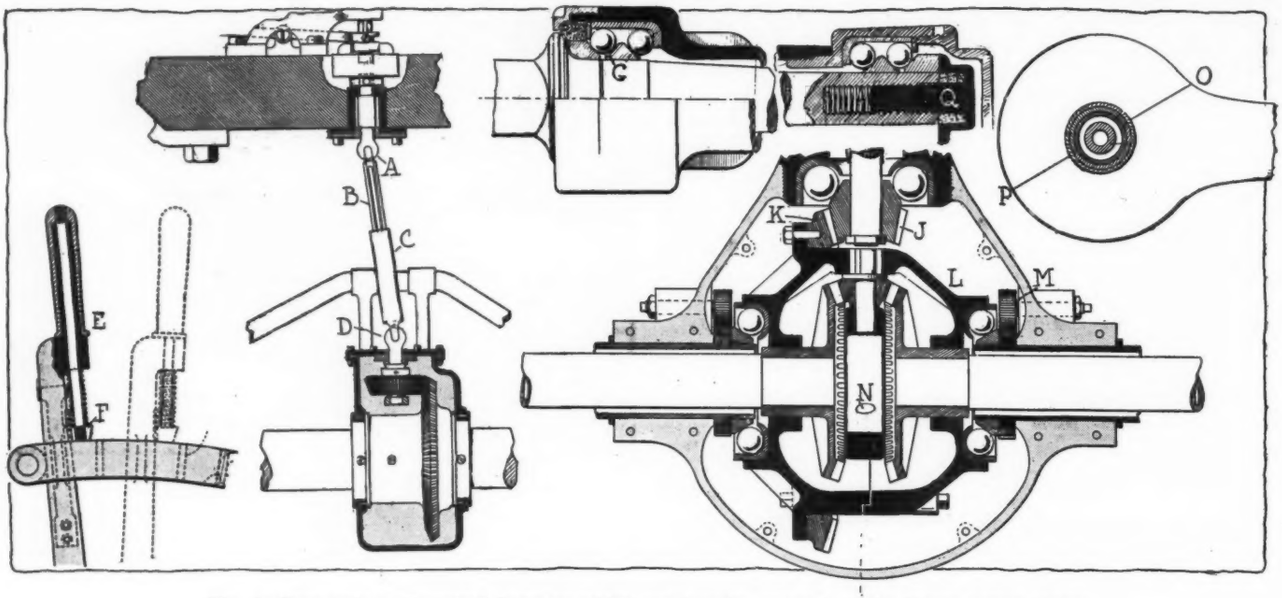


Fig. 1—Rear axle and control features which are broadly covered in the Kardo patent claims

High Spots in Kardo Patents

Gearset, Rear Axle and Control Features Covered by Eight Patents—Many of the Claims Interlock

THE eight patents now owned and controlled by the Kardo company present a formidable array of claims dealing with the gearset, driving mechanism and rear axle construction of the automobile. These claims are so closely interwoven that the combined ownership was absolutely necessary in order to prevent a long series of involved patent litigation on the part of the big companies using them.

An outline of the claims presented in these patents has been given in the issues of THE AUTOMOBILE for March 12 and March 19, but for ready reference the principal claims now in actual use are picked out and illustrated on these pages.

Patent No. 608,017, taken out on July 26, 1898, is the oldest of the eight Kardo patents. It was taken out by Walter C. Baker, of Cleveland, Ohio, and assigned to the American Ball Bearing Co., of the same place. It has to deal with an antifriction ball bearing for use on the axles of an automobile. By the use of this device it is possible with a single operation to adjust the play in the wheels when a cup and cone bearing is employed. The Baker bearing is illustrated in Fig. 1 at G. The ball bearing assembly is shown at Q. The housing is provided at the outer bearing with the same annular chambers and bearing rings as are shown on the inner bearing. By taking up on the adjusting nut, Q, at the end bearing the sleeve, bearing, rings and balls are all brought into proper adjustment at the same time, since moving the adjusting nut gives a simultaneous motion through these parts, as the drawing illustrates.

Hopewell Compensating Shaft Drive

Patent No. 664,478, taken out on Christmas Day, 1900, ingeniously provides a method of compensation for the inequalities of the road surface. The leading features of the patent are a telescopic shaft connected by universal joints to the driving mechanism. Referring to Fig. 1, a diagram of this drive is given. The motor is connected by means of a clutch to a stub shaft, A, which in turn transmits the drive through a universal joint to the telescopic shaft, B, C. From this point the drive is again taken through a universal joint to the bevel drive.

This invention allows the rear axle to rise and fall through the operation of the springs, in relation to the body of the car. The universal action provided in the shaft is still in use, although the telescopic arrangement has long since passed into the discard. The springs referred to in this invention were mounted on the rear axle.

Baker Provides for Adjustment

Two features stand out in the patents 608,017, taken out by Walter Baker, of Cleveland, Ohio, in February, 1905. These are the use of a split differential casing and of an adjustment feature which allowed for the adjustment of the ball bearings without removing the differential casing. Referring to Fig. 1, P, the split differential casing is shown.

The means for adjusting the ball bearings without opening the split housing are not illustrated, but they employed a simple gear tooth arrangement by means of which, by turning a nut, the small gear rotated a screw thread carrying the ball bearing cone, thus tightening or loosening the cone as required.

An interesting part of the Baker patent which has passed out of use is a rod through the hollow rear axle, which passes out through one side of the axle and which was connected to the other axle shaft. This rod acted as a tie rod and prevented any spreading of the two axles.

Brush Invents Differential

A differential action patented by A. P. Brush, of Detroit, Mich., and assigned to the Baker Motor Vehicle Co., of Cleveland, Ohio, is one of the important Kardo patents. It is numbered 792,690, and dated June 20, 1905.

A section through the Brush differential is given in Fig.

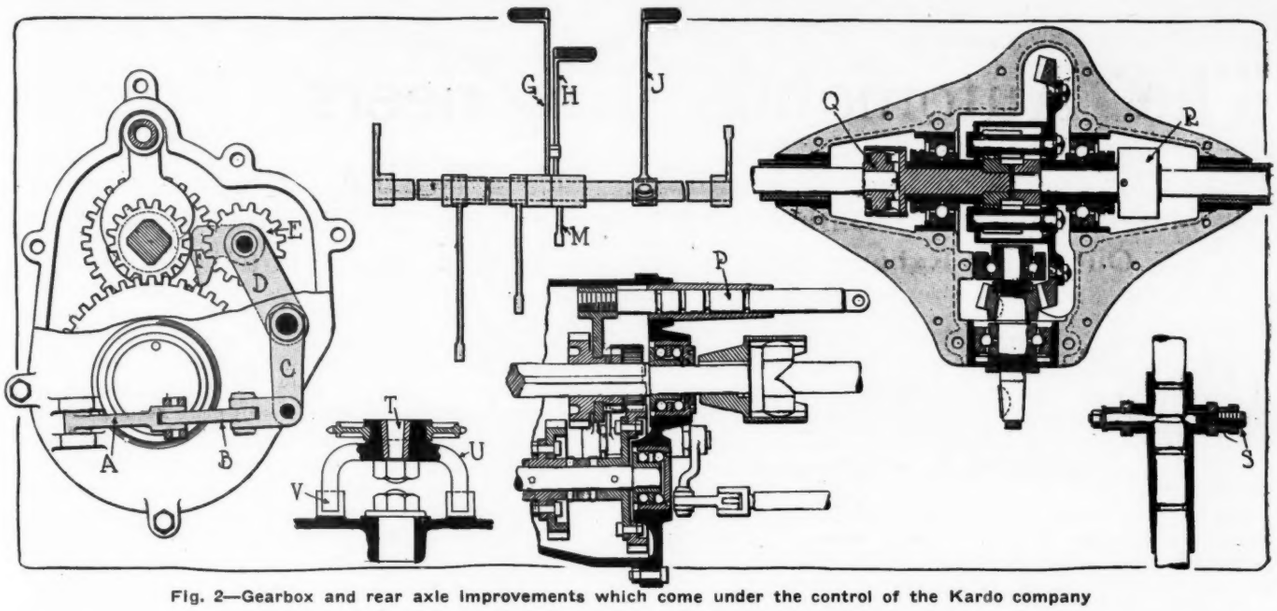


Fig. 2—Gearbox and rear axle improvements which come under the control of the Kardo company

1, N. Its purpose was to considerably simplify the differential action and at the same time give accurate compensation for a difference in the speeds of the outer and inner rear wheels.

Referring to the illustration, the drive shaft J meshes with the large bevel gear, K, which in rotating carries with it the differential assembly, L. The assembly carries with it the small shafts, with their bevel differential pinions. These in turn mesh with their corresponding gears carried upon the inner end of the axle shafts. The differential pinions on the shaft are loosely carried on their shafts, and thus provide the differential action. Long slots in the housing permit of the adjustment and alignment of the differential mechanism. Adjustments can be made on the ball bearings without opening the casing which can be made oil tight. The means of adjustment are small gears, M, which can be turned from the outside of the housing by means of a nut. These gears provide for the moving of the ball bearing cone.

Schmidt Patent Locks Gears

Charles Schmidt, Detroit, Mich., took out on February 22, 1910, patent No. 950,191, which specifies a gear locking device that was assigned to the Packard Motor Car Co., and which is used on cars of their manufacture.

The device consists of a slotted rod, which has a separate slot for each speed; this device is shown in Fig. 1 at P and S. When a gear is shifted into position the rod is moved along and the spring latch shown at S engages the slot, thus preventing the gears from slipping out of place, unless the locking mechanism is disengaged by the operator. The slotted rod is carried within the gearset housing and the spring latch engages with it during the time that any forward speed or reverse is in mesh. The spring latch is engaged and disengaged by means of a lever actuated by the gearshifter rod, E, F.

Another patent by the same author numbered 1,013,450, provides for the prevention of accidental reverse, and also provides a means for adjusting the rear axle bearings. This patent is also assigned to the Packard Motor Car Co., and is dated January 2, 1912.

Referring to the illustration, the means for preventing the reverse gear from being accidentally thrown into position are shown. A shoe or extension, F, is carried on the end of the arm, D. This shoe projects beyond the reverse gear E, preventing it from engaging with its corresponding gear when it is not properly registered with it. When the register is proper there is an annular groove into which the shoe can drop and thus be out of the way without interfering with the engagement of the reverse gear. The linkage for operating the reverse is shown in the illustration at A, B, C.

Sangster Patents Cover Broad Field

The Sangster patents, taken out by Charles T. Sangster, of Birmingham, England, on July 22, 1902, and numbered 705,304, cover many broad and useful features dealing with the control of the speed change and driving mechanism. The various devices under this patent are to provide a three-speed gearset with one reverse, and methods of controlling and assembling same together with dust and grease tight housings. Taking some of the high spots of the many broad claims listed under this patent, one of the most noticeable is the arrangement provided for carrying the change speed lever, brake pedal and emergency brake lever all on one shaft transversely across the vehicle. By mounting all the control features on this transverse shaft a simple and easily assembled control is provided. This arrangement of levers on the single carrier shaft is shown in Fig. 2, G, H, J, M.

Another feature of this patent is an easily assembled clutch, which may be removed in its entirety without disturbing any other parts. This assembly, which is shown in Fig. 2, is so arranged that at the end of the crankshaft, T, there is mounted a forked coupling, U, by means of which the engine is connected with the driving part of the clutch. By this arrangement either the motor or the part on which the clutch is mounted, which in this case is the gearset housing, can be removed from the supporting frame without disturbing any other part. It is also designed to permit the car builder in assembly to secure the correct amount of clearance between the crankshaft and the clutch.

Patent No. 832,991, dated October 9, 1906, and reissued June 1, 1909, to Louis P. Mooers, Geneva, Ohio, is assigned to the Peerless Motor Car Co., of Cleveland, Ohio.

The important feature in this patent, which is illustrated in Fig. 2, is the floating construction of the rear axles, which can be withdrawn by simply removing the hub caps. At the inner end of the axle is a sleeve, R, with apertures to take a crosspiece on the inner end of the rear axle shafts. The inner ends of the axle shafts are operated directly from the differential gears through the telescoping connection, which, while giving them a rotating movement, permits the axle sections to be drawn outward when desired. The hub mechanism is so designed that the wheel bearing is carried on the outside of the axle housing giving a floating arrangement, and the cap is fitted to the hub of the wheel, being independent of the axle shaft.

The Automobile Engineers' Forum

Pleads for Increased Operating Efficiency, Decreased Fuel Consumption and More Complete Utilization of Thermal Units—Deficiencies Brought Out by the Exhaust Gas Analysis and Fuel Consumption Tests

Exhaust Gas Analysis—Part III

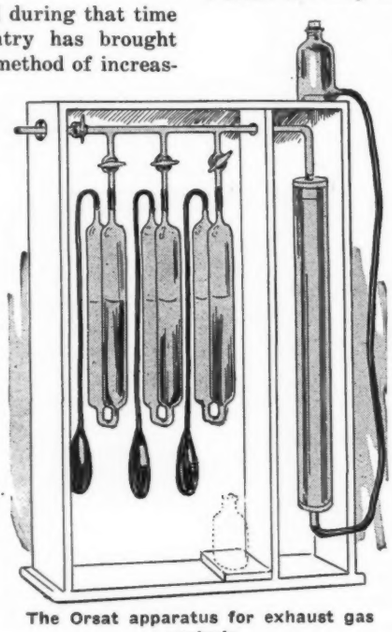
PITTSBURGH, PA.—Editor THE AUTOMOBILE:—Although I am not even a mechanical or electrical engineer, to say nothing of an automobile engineer, I wish you would allow me to express myself in The Engineers' Forum for I wish particularly to reach the engineers of the industry.

For 5 years I have been a car owner and during that time the increasing cost of fuel in this country has brought forcibly to my attention the need for some method of increasing economy in that expensive particular.

Tests Were Practical

In this connection the exhaust gas analysis and fuel consumption tests conducted by THE AUTOMOBILE and described in the issues of February 12 and 19, seemed to me to be of unusual interest to both the engineering and the motoring fraternities. What appealed to me especially about these tests was that they were not purely theoretical, as are so many affairs of the sort, but that they brought out the actual fuel consumption and exhaust conditions of modern cars, the kind of cars designed by the engineers and bought and driven by the motorists of today.

Many of the engineers whose views on the tests have appeared in the Forum seem to me to have missed some of the most important points. For example, it was especially significant to me to note that in the case of nearly half the cars tested the carburetion was found to be poor. This is a rather high ratio and would seem to indicate that our engineers have something to do besides the designing of little beautifying features, etc.



The Orsat apparatus for exhaust gas analysis

On a ton-mile basis Car No. 1 showed the highest efficiency on the tests, giving 31, as compared with 26.6 for the car which showed the next best results, obtained from Car No. 2, which, it must be remembered, was a six-cylinder car. And even in the case of No. 2 the record of the gas analysis test shows that the mixture was too rich for economy and also probably for best power. The result of such a mixture is, of course, that combustion is incomplete, with a consequent loss of power, in this instance 17 per cent.

Knight Motor Did Well

It is interesting to note that the six-cylinder cars made such a passable showing, although the number of miles per gallon of fuel obtained with them as compared with the four-cylinder types is considerably less. Car No. 6 gave only 7 miles per gallon and Cars Nos. 3 and 7 gave 8.7 and 9.4, respectively. The best results obtained with a six-cylinder car, the 9.9 miles per gallon of Car No. 11, do not compare very favorably in respect to economy with the 13.3 miles which the four-cylinder car equipped with a Knight motor, No. 9, gave per gallon of fuel. This is an interesting comparison.

It is evident that there is much still to be accomplished in the direction of increasing the operating efficiency of cars, both four and six-cylinder. By increasing operating efficiency I mean not only the reduction of fuel but also the utilization of every available molecule of heat energy in the motor, the practical application of every unit to the propulsion of the car.

That such an increase in efficiency is possible may be readily seen by referring to the progress made in Europe, and in particular that in France, England and Germany in this respect. Of course, no one has reached perfection but it must be confessed that, as necessity is the mother of invention, the necessity for off-setting the high price of fuel in those countries has driven the engineers to design cars which are far more efficient in the particulars I have enumerated than the machines turned out in American factories.

Effect of the Cyclecar

Another factor to be considered is the rise of the cyclecar and its effect on the automobile-buying public. That is, when a man can purchase a cyclecar for a low price and then have a proportionately low upkeep cost will he not pause a while and question himself before he invests in an automobile, which not only costs more to begin with, but also has a far higher maintenance expense?

These are some of the phases of the subject of fuel economy which occurred to me on reading the report of the tests. These and other points, it seems to me, should have been driven home to our engineers as well as to the car owner, the man who may some day buy a new machine and who is thus interested in the progress of American design and the development of American ingenuity in combating the problems of wasted power and excessive fuel consumption.—J. T. L.

Recommends Use of Wire Rims Instead of Wider Tires

BROOKLYN, N. Y.—Editor THE AUTOMOBILE:—In reference to automobile tire efficiency, the pneumatic tire manufacturers are continually urging the use of broader tires on all cars, but there is always much doubt as to whether the increased life of the oversize tires compensates for the increased cost of the larger tires.

Instead of using larger size tires, the same result can be obtained by using rims that are considerably broader than is usually the practice at the present time. The wires in the

beads of the quick detachable tires will hold the smaller size tires in place on the broad rims without trouble even in this unusual position.

Flatter Tire Makes Better Riding

This arrangement will cause a much broader surface of the tires to be presented to the ground tending to much easier riding qualities of the car, a condition much to be desired, especially as it entails no increase in the cost of tires. This will also allow a greater number of square inches of tire surface to carry the weight of the car and this will therefore allow of a considerable reduction in the air pressure in the tires, thereby reducing the liability of blow-outs to a minimum. This should be a good opportunity for the demountable rim manufacturers to make some experiments along these lines and put a broad size demountable rim on the market that can be used on the wheels now in use.

Some years ago, I owned a light Maxwell runabout and I inflated my tires only sufficiently to avoid the side bellying. My tires always ran until they were very thin on the threads and were practically worn through before being discarded. How many modern tires do this?

With all the talk about high air pressure in tires, no matter what attention has been given to the tires, nearly all tires that have been discarded as junk, still have much rubber left on the treads, but they are blown out and worthless as tires. On all weights of cars, I find it to be much better and cheaper on tire cost, to inflate tires well only when brand new, but as soon as they show any signs of wear or weakness, to reduce the air pressure considerably or they will surely blow out long before they are worn out on the treads. The tire manufacturers seem to overlook the fact that an old tire will not and cannot stand the high pressure they advise their customers to use on their tires.—EMIL HOH.

Claims Proper Shock Absorber Will Keep Axle in Position

LOS ANGELES, CAL.—Editor THE AUTOMOBILE:—Referring to the discussion appearing in recent numbers of THE AUTOMOBILE as to whether or not shock absorbers designed to dampen only the expansion of automobile springs have a tendency to cause the wheels to bob through the lifting effect such devices would have on the axle of the vehicle:

In THE AUTOMOBILE for January 29 you published a communication from me, to the effect that devices of this character would not lift the axle and thereby cause "bobbing" of the wheels, by reason of the well understood fact that expanding springs must of necessity exert an equal force in both an upward and downward direction.

In THE AUTOMOBILE for February 19 there appeared a communication bearing on this subject from T. S. Harris, in which the statement is made that in my previous communication on this subject the point was evaded that "less force is exerted in either an up or down direction by dampened spring recoil." Inasmuch as the well understood purpose of a spring damper is to *cause* a spring to exert less force, as stated, it should hardly be termed an evasion to have left out such an elementary conclusion.

Normal Axle Position the Question

Your correspondent states further that this lessened force produced by the use of such a shock absorber would tend to prevent the axle from returning to its normal position. The discussion relates as to whether or not the axle will ever be caused to leave its normal position. My contention is, that the use of a properly made one-way working absorber will not only not cause the axle to leave its normal position, but, on the contrary, will prevent its doing so.

Further, the communication relates that "both the upward movement of the body of the car, and also the tire strain produced by a wheel mounting an obstacle, is greater when the compression of the spring is dampened, since the action of the spring is stiffened thereby." This is, of course, perfectly true with the two-way working type of absorber, but this statement goes to show that the communication from Mr. Harris is not germane to the subject under discussion, which, as I understand it, refers to the type of absorber which damps only the recoil and has no effect whatever on the compression of the spring, and therefore cannot stiffen the springs or cause consequent discomfort to the passengers.

Perhaps a Different Type of Absorber

Assuming that your correspondent has in mind an entirely different type of absorber from the one under discussion, I do not consider that any further attempt on my part to answer his conclusions will be of benefit to your readers.—J. P. BALDWIN, President, Martin Shock Absorber Co.

Detachable Cylinder Heads Permit of Enlarging the Valves

FLINT, MICH.—Editor THE AUTOMOBILE:—Detachable cylinder heads on our type motor, the valve-in-the-head, allow us to do away with the valve cage and I believe that in doing away with the cage, we eliminate a lot of trouble, for on motors with the valve cage construction, the cage takes up considerable room, which could be used to advantage in enlarging the valves. Also the cage keeps the valve at a considerable distance from the water, making an extra seat to warp and leak.

The detachable head construction makes the motor very accessible for cleaning out carbon, and grinding the valves, the head being detached and laid on the bench, where it is easy for a man to get at it and grind the valves, and at the same time scrape the head to clean off all the carbon. In the machining of the cylinders it is much easier to machine, inasmuch as the boring mill bar can be run entirely through the cylinder, allowing the making of the top half of the crankcase and cylinders in one block, which makes a very rigid construction.—J. T. TRUMBLE, Chief Engineer, Chevrolet Motor Co.

1-Foot Acetylene Burner Gives 44 to 48 Candlepower

INDIANAPOLIS, IND.—Editor THE AUTOMOBILE:—This is in reply to questions asked me by one of your readers in your issue of February 12.

J. E. White asks what is the actual gas consumption to equal the light produced by 16, 21 and 24 candlepower electric head lamps, 4 and 6 candlepower side lamps and 2 candlepower rear lamps. The light from a 1-foot acetylene burner (that is, consuming 1 cubic foot per hour) is 44 to 48 candlepower. There is some variation in this, largely due to the fact that it is practically impossible to manufacture a burner with such absolute accuracy that it will consume just exactly 1 foot per hour, but this is approximately correct.

Therefore, the 1-2-foot acetylene burner used in the average gas headlight produces a light of from 22 to 24 candlepower, while the somewhat less common 3-4-foot burner gives a light of from 33 to 36 candlepower. A 1-8-foot burner is sufficient for use in side and tail lights and this gives between 5 and 6 candlepower.

Mr. White also asks the actual cost per cubic foot of gas. The size B Prest-O-Lite tank holds 40 cubic feet. The average price of an exchange, the country over, is $2. In Cleveland the price is $1.50. So the price per foot is somewhere between 3 1-2 and 5 cents. The variation is explained by the fact that dealers in towns at any distance from a charging plant have to pay freight, etc.—R. H. COOMBS, Prest-O-Lite Co., Inc.

System Based on Skeleton of Forms

Hartford Suspension Co. Cuts Stock Taking Time From 2 Weeks to 4 Hours—Work Follow-Up Scheme Used

By J. Edward Schipper

NOT more than 6 months ago it would have taken the Hartford Suspension Co. 2 weeks to make a complete inventory of its stock. Today, it can be done in 4 hours. The system which has brought about this complete transformation is a simple one and is based on a method of stockroom and storekeeping which maintains a perpetual inventory of the contents of every bin.

In addition to the perfected stockroom system, the Hartford Suspension Co. has created a follow-up system which enables the adminstrators to tell at any time in what condition any job going through the factory is in. These two systems, that of storekeeping and that of following up the work, intermingle and form the economics of the plant.

Duplicate Records in Office

Starting with the stockroom for raw material, outside of each bin hangs a card similar to that shown in Form 1. On this card the name of the article, its size, location and unit weight are noted. Beneath this there is a double-column ledger which shows the amount received and the amount taken out. The storekeeper issuing the material is required to enter in the balance column the amount of material remaining in the bin immediately. From each preceding balance he subtracts the material just issued and notes the resulting balance in this column. It is only necessary to look at the card to know how much material is in the bin. The same rule is carried out at the stockroom for finished material.

Whenever an order is made out in the office the necessary amount of material to carry this order through is noted and on a blank which is a duplicate of that hanging on the outside of the bin, the same record of the material received and issued is kept. In this way there are two complete inventories of the contents of every bin, one in the storeroom in which the bin is located and the other in the office. Every day several of the records are compared to see if the balance of material recorded on both the card at the bin and the blank in the office coincide. When this verification is made the date is put under the head Verification, thus informing both the office and the storekeeper of the dates at which the last check was made on the records.

Arriving Goods Inspected

At the top of each card are the headings High and Low. Opposite the mark High, a number representing the maximum contents of the bin is placed and opposite Low, the minimum. When the contents of the bin fall below the low limit a notification of this fact is sent to the production department on Form 2. If raw material is required the purchasing department puts through an order at the direction of the superintendent. This order from the superintendent is made out on Form 3, which is a direct result of the notification given on Form 2, where the list of articles which have fallen below the low limit of the bin are noted. The stockkeeper signs the notification and the superintendent signs the purchase requisition.

Should the order which the purchasing agent is required to make be a large one, and should the goods begin to reach the superintendent too rapidly, a stop order made out on Form 4, which is a salmon-colored blank, informs him of this fact and causes him to notify the senders to stop forwarding that particular material. When the material is again required, a continue order is given on Form 5 and the purchasing agent is requested to order the continuation of the material.

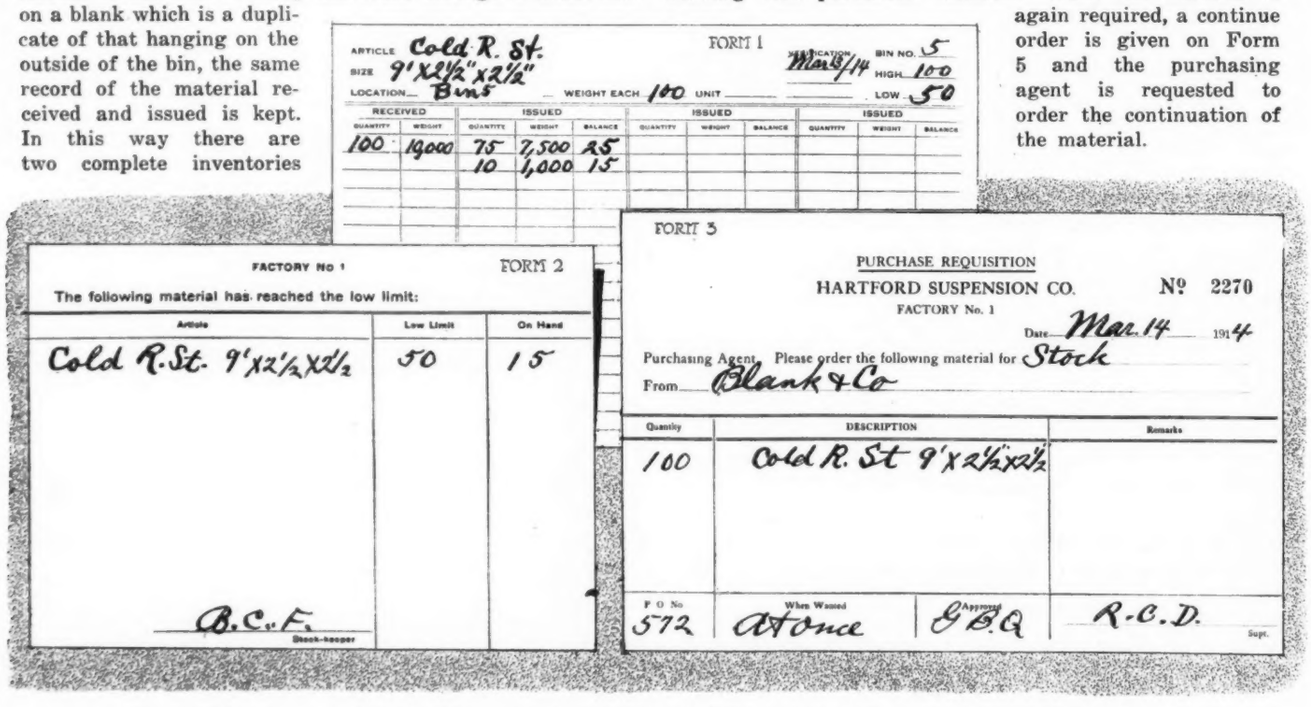


Fig. 1—Three forms used for keeping account of raw and finished material. Form 1 is a perpetual inventory

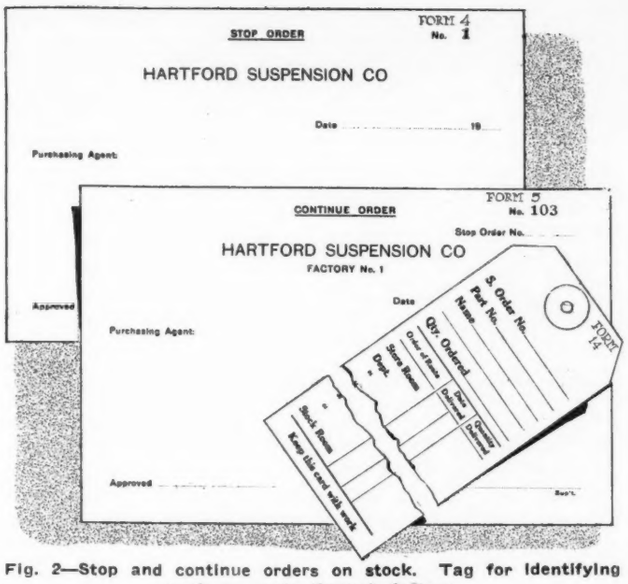


Fig. 2—Stop and continue orders on stock. Tag for identifying work on route through factory

As the finished material comes into stock it is gone over by an inspector who must approve before it is stored in the bins. A record of the inspector's work is forwarded to the cost department on a blank similar to Form 6. On this blank the amount to which the department finishing the work is to be credited is noted, the order number is shown and the date of inspection. Under the head Quantity there are two departments, the upper space being for a list of the good material and the lower part being for the scrap. The cost of producing the material and the value of the scrap is noted and these two amounts go toward making the cost records. Before the storekeeper can accept the articles, the blank must have been signed by the inspector, and before returning the blank to the cost department the storekeeper acknowledges by his signature that the articles have been placed in the storage bins.

Raw Material Inspected

When the raw material comes to the factory it is inspected and all defective material is laid aside. The goods upon being O.K'd. by the inspector pass into the storage bins and are credited on the perpetual record hanging on the outside of each bin and in the office. That found defective is called to the attention of the superintendent, who requests the purchasing agent on Form 7 to return the defective material. On this blank the quantity and description of the material is given and any necessary remarks as to why the material should be returned. On receipt of the notification from the superintendent, the purchasing department orders the receiving clerk by Form 8 to return the defective material. On this form the number giving a key to the returned order on the books of the stores and factory is entered and also the quantity and description of the goods and the cost. This is signed by the purchasing agent, approved by one of the officers of the company and signed by the receiving clerk to note the date shipped.

To record the return of the defective goods the receiving clerk fills out a blank similar to that shown in Form 9, a stub in the book from which this is torn furnishes him with a duplicate record, and Form 9 is then sent to the office, where it forms a record showing from what department the goods were returned, the date and how they were shipped. The lower part of the blank gives the quantity and description of the goods. In order to keep a record of them in the auditing department so as there will be no danger of the full amount of the consignment of material being paid for when part has been returned, Form 10 is made out by this department in duplicate, one copy is sent to the company to which the goods have been returned and the other is kept as a temporary memorandum attached to the account of the party to whom the goods have been returned until the latter shall have sent one of their own memorandum, acknowledging the return of the goods.

Work Followed Through Factory

When an order starts through the factory an order is made out on four blanks, Forms 11-A, 11-B, 11-C and 11-D. Eleven-A and B are shallow blanks, while C and D are exact duplicates except that one is on light paper and the other is on heavy manila. As will be noted all four forms are similar at the top. They are made out with three carbons so that a minimum amount of time is consumed in this operation. Eleven-A is a blank for a cost record; it gives the number of the pan or box in which the work will be kept on its various steps through the plant. It gives the number of the part corresponding to the number in the parts book, and, on the same line at the top, the order number. Below these three figures is a space for the date of the order and the department in which the work is to be started. Below this is the quantity of the material, a description of it and a space in which the amount can be entered. On the bottom two lines are blank spaces for such information as the number of parts wanted, the number in each box, the drawing number, etc. On the reverse side of this blank the date, the department doing the work, the number of hours of labor, the cost of the labor and the overhead are entered. A summary of this is made and the unit cost per piece is calculated and entered on this blank, thus forming a valuable record for the cost department.

Form 11-B contains the exact same information as the first mentioned side of Form 11-A, but, instead of being headed Cost Record, it is headed Order for Stock. This blank is not printed upon the reverse side and is used merely as the authorization of the foreman of the department which is going to do the work, to secure the material necessary from the stockroom. In other words, Form 11-B may be used directly as a requisition if desired and thereby cuts the time which is generally required in making out requisitions by having this requisition made out in the office at the time that the order is sent out.

As mentioned above, Form 11-C and 11-D are duplicates. The upper part contains the same information as A and B, being a duplicate of them with the exception that they are now printed on the reverse side as is the case with

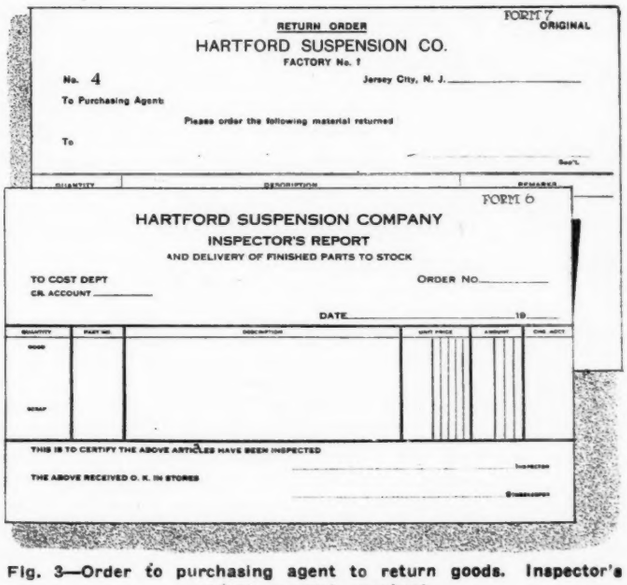


Fig. 3—Order to purchasing agent to return goods. Inspector's report on goods received

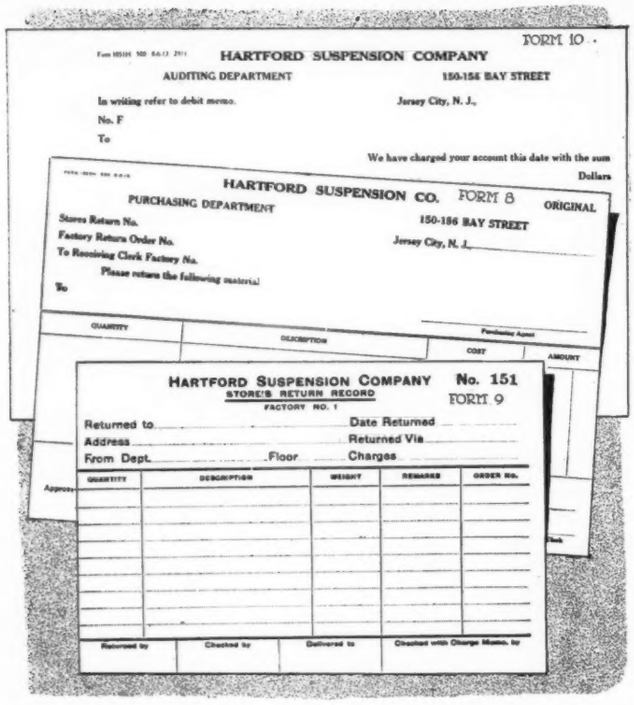


Fig. 4—Forms showing three steps in returning goods through auditing department, purchasing department and shipping room

the cost record Form 11-A. Form 11-C remains in the office while Form 11-D, the heavy manila one, goes to the foreman and is his authorization for starting that particular job under way. This form has a continuation below that of Form 11-C and 11-D and on it the information relating to the actual carrying out of the work in that particular foreman's department. The date is given, the number of operations, and the rate per piece together with the date of delivery, the number rejected, the workman's number and the foreman's O.K. At the right side of the card the record of the finished work sent ahead is entered.

Supplies Charged to Overhead

Should the foreman of a department require supplies in the nature of oil for the machinery, waste or other articles, which do not enter into the actual production of the pieces but which are chargeable to burden or overhead, he has at his disposal a supply requisition, Form 12. At no place it will be noted is a supply requisition charged to any particular order but instead goes to form a part of the general overhead expense. Should material be required, however, the foreman makes out a requisition upon a material requisition blank which is so labeled. This blank, Form 13, bears the words, Please Charge All Material Drawn on This Requisition to Order No. —.

In order to keep the foreman's order clear on a definite job, a special tag of heavy material, Form 14, follows the job wherever it goes. On this is noted the order number, part number, quantity, and its route through the factory. The card never leaves the work. When the job is finished and the tray containing the finished parts is delivered at the foreman's desk, he notes the order number on this card and checks up the work with that on his large order given on Form 11-D. If he finds it O.K. he turns it over to the inspector and after the latter has done his work, the foreman sends into the office and to the foreman of the department to which the work must proceed, a duplicate blank Form 15. The form sent to the office and that to the foreman of the next department are exactly the same except that the office report is the original and is marked Production Report. On this blank the order number is given, the workman's number who did the work, a description of the job, number of the part, number made, number defective and a notification that this finished job is ready to go ahead. It is this form which marks the progress of the work from the raw material through each department until it reaches its final destination, the inspector who looks over the work before it goes into the hands of the shipping department.

Inspector Keeps a Record

When the work reaches the inspector he goes over it and on Form 16 notes the result of his inspection. On this blank, which is labeled Inspector's Report and which eventually goes to make up a part of the records of the cost department, is noted the quantity of finished parts, the number of the part and a description, together with the unit price, the total amount and the order to which the expense of manufacture must be charged. This report is signed by the inspector and goes with the finished work to the shipping department. The shipping clerk checks the amount of work in the box with the record on the inspector's report and then, finding that the amount checks correctly, he fills in the bottom of the blank stating that the goods have been received O.K. in the shipping department. This he signs and then forwards the blank to the cost department office. He holds the goods in the shipping department awaiting notice from the office for shipping directions.

In estimating the amount of material needed to fill a certain order, it very often happens that a mistake will be made and too much stock will be taken from the raw material bin. As every bit of stock which is drawn is charged to the account of the particular order for which it is required, this would give rise to an error in the cost records were not the surplus stock again credited to the account of this order. To take care of this, Form 17 is provided. On this blank the

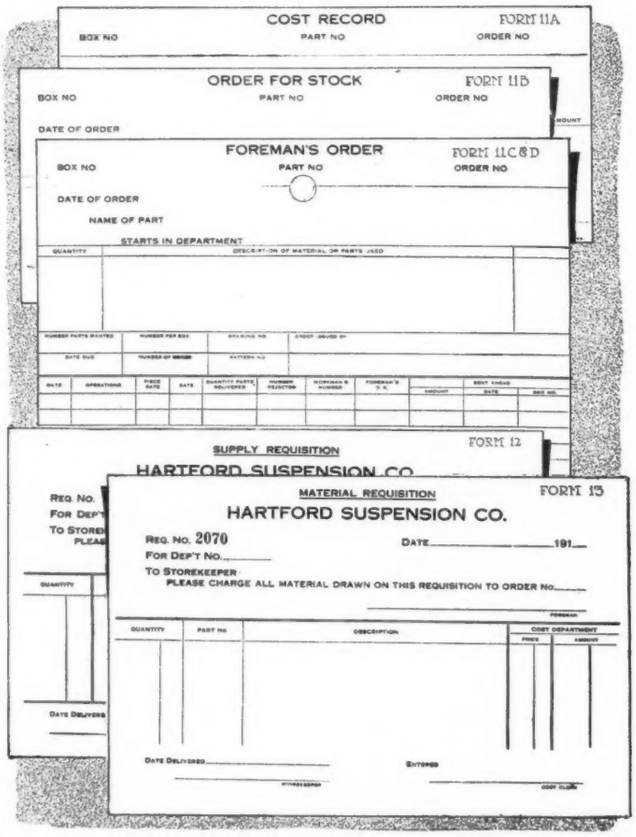


Fig. 5—Orders for the starting of a job. Supply and material requisitions

storekeeper signs for the return material on that particular order and the blank is forwarded to the cost department so that the amount may be credited to the order on which the charge was made.

Blanks for Contingencies

The forms noted are the skeleton around which the system of the Hartford shops is operated. There are other blanks which take care of certain contingencies without necessitating a large amount of bookkeeping, or even special books. Among these auxiliary forms may be mentioned that in which work sent outside is taken care of. For instance, if a certain job is to be nickeled-plated, at the same time that the order embracing the series 11 forms is made out, an extra carbon is inserted which directs that the work be nickel-plated. This extra form is sent to the company which does the nickel-plating work and furnishes the instructions on this job. In other words, outside work is handled virtually the same as if it were a department of the Hartford factory.

Another useful form is in the shape of a linen tag for use on work which is sent back for repairs or for any other purpose. Very often the article sent back will reach the factory before the instructions regarding its disposition. In order to prevent any confusion, this tag is attached to the object and on it in the spaces provided is recorded the return number, the number of the bin, the section the bin is in, the name of the company from whom it is received, the address of the company, charges which were paid upon its receipt and a complete record of anything which may be deemed necessary included under the head Remarks. A duplicate of this card in the office keeps the bookkeepers informed as to the location of such returns.

To take care of special jobs of an experimental nature, a special blank is prepared for this work. On this blank is recorded what the work is for and to what order it must be charged. If it is just general experimental work, it is charged to burden or overhead. The same may be said of tool construction orders for which a special blank is made in very much the same form as the experimental shop order. These tool construction orders, however, are generally chargeable to a definite job and do not enter into the overhead.

In the factory the men are paid on a straight time basis with time plus 50 per cent. for overtime work. An efficiency time calculator is used in which by means of a specially prepared diagram the timekeeper can compute in two seconds the exact amount of money due any man on any job. This is done by means of a card in which the time is entered together with a record of what the man was working on at any time and a calculating table which checks up with the card.

What It Costs to Own Cars in France

PARIS, March 3—France needs a few million francs for additional expenditure on roads and is endeavoring to squeeze the amount out of automobile owners. Before its overthrow a few weeks ago, the late government had a supplementary automobile taxation bill before the house and also proposed to increase the rate of taxation under the income tax law when the person owned an automobile.

Supplementary Tax Proposed

Almost as soon as it got into power the new government introduced a bill under which a supplementary tax should be put on cars. This is at the rate of $10 for cars of not more than 12 horsepower; $15 for 13 to 24 horsepower; $25 for 25 to 36 horsepower; $40 for 37 to 60 horsepower, and $50 for each car of more than 60 horsepower. These proposed taxes are in addition to what is at present paid.

It is believed that the revenue will be $1,600,000, and this amount will be expended entirely on the improvement and maintenance of national roads.

Opposition to More Taxation

All the automobile trade associations are making a very determined stand against increased taxation. It is pointed out that there is no guarantee that the new taxes will be used for the improvement of roads. The government revenue from automobiles has increased enormously during the last 10 years, but the amount spent on the upkeep of roads has remained stationary. It is because of this policy that the road surfaces in France have decreased.

As a proof that the amount now paid in automobile taxes is out of all proportion to the allotments for road maintenance, the Chambre Syndicate of Automobile Manufacturers have issued the following figures:

Year	Receipts from Road Users	Expenditure on Roads
1882	$2,936,375	$5,207,165
1902	8,898,679	5,207,165
1911	18,073,129	6,100,000

In 1882 the average expenditure for the upkeep of one kilometer of road was $138.76; in 1892 the amount was $145.06 per kilometer; in 1902 it was $151.97, and in 1911 it was $159.56. The increase from 1882, when there was nothing but horse traffic on the roads, to 1911 when more than 100,000 automobiles shared and paid for the use of the same roads merely covers the increased cost of labor and material.

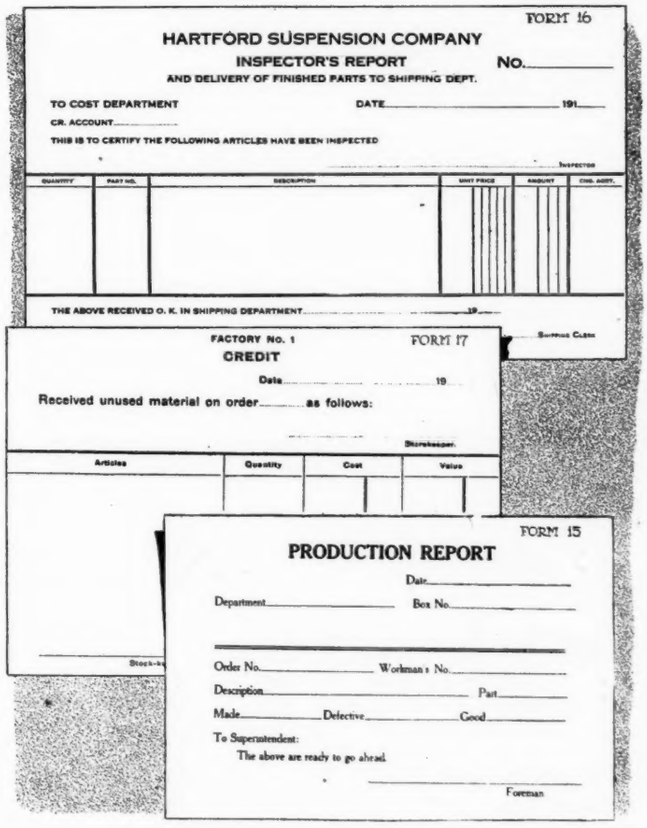


Fig. 6—Inspector's report on finished work, return slip for unused material and notification given by foreman that work is finished

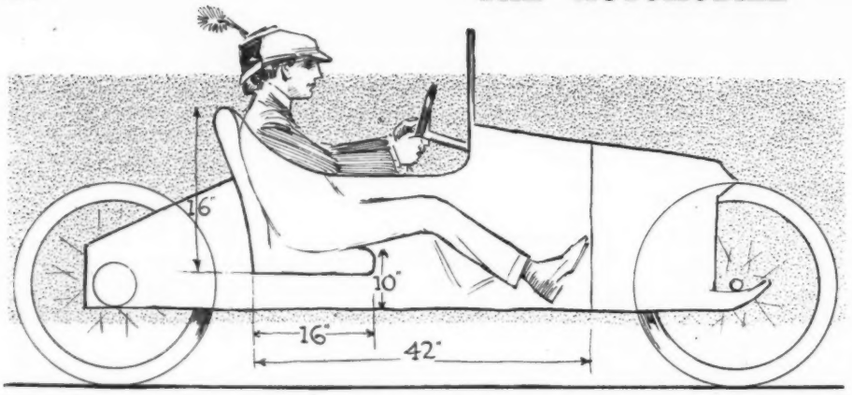


Fig. 1—Dimensions of low-hung side-by-side-seating car. Tread and seat width should both be about 40 inches, for comfort

Wind Resistance vs. Sociability in Cyclecars

Three Methods of Seating—Tandem, Staggered, Side-by-Side—Dust Protection and Low Gravity

By William B. Stout

THERE are three methods of seating in use in cyclecars; tandem, semi-tandem or staggered, and side-by side. Each type has its particular field of usefulness, and its advantages and disadvantages, and each will survive in numbers proportionate to its merits. At present the greater number of American cyclecars are tandem seating, with staggered seating next.

The past has seen many cyclecars, from the single-cylinder air-cooled Crestmobile, to the Orient Buckboard; cyclecars in idea if not in fact, for then the name was not invented and they were simply types of horseless carriage. With all of these and the O. T. A. V. in England—a side-by-side chain-belt drive car with the motorcycle motor built in London in 1907 and sold in small quantities—there was no cyclecar craze until Borbeau showed the new idea of tandem seating.

The Bedelia made its hit through its originality. It was a very crude affair, and unwieldy, but it held an appeal of sportiness and England took it up. At once the public spoke, and in the cyclecar movement saw only a new small motor car, and asked for motor car specification. The result is that the English cyclecar movement has failed—they only make small cars, many of them of indifferent success. No real engineer has tried to make a maximum-simplicity car in England and hence none has been produced.

Why England Failed

Borbeau's idea in the tandem-seater was to get maximum results from minimum horsepower and weight. He started to produce a minimum-expense vehicle and did so—with the limitations of crude workmanship and scant capital. That England failed to discover the cyclecar was due to the fact that she lost sight of maximum-efficiency and low cost and also to a lack of knowledge of quantity production method, following the public rather than rational engineering for the new problem.

In America tandem seating was tried first, and with this was put some radical, though tried out, engineering. The result was the explosion of the theory that to be easy riding a car must be heavy. In the simple type, narrow-tread car was discovered a vehicle which gave a new class of performance.

The average public used to motor car arrangements is at loss to understand why by far the greater number of cyclecar firms are building very narrow tread cars, and why those who build the wider tread and body types are fast adopting water-cooled motors above the cyclecar limit of cylinder dimension. The public offhand wants to sit next to its passenger, and offhand and without too deep thought, speaks out for side-by-side seating. The makers feel that there is this feeling with the public and yet, knowing car limitations, many of them make tandem seating cars.

Former articles have discussed the items of wind resistance, the importance of narrow tread and low weight as a minimum-power-consumption and maximum-efficiency-and-comfort item. A discussion of tandem, semi-tandem, and side-by-side seating arrangements will bring out again some of these points in relation to each design, and emphasize others. It is not intended in this to criticise any type but to point out the items which must be remembered in each design to make it a success.

In tandem-seating the argument is on sociability; hence this type of seating must be built to allow of a maximum of conversation and friendliness between driver and passenger; side-by-side seating makes a car of great width for the minimum tread and maximum efficiency type, and hence every item in this design must be to cut down the power required to push the car; items such as road resistance, wind resistance and side sway. With the semi-tandem or staggered seating a compromise between the two is found with some of the advantages and disadvantages of both, and this type is growing in favor, but even here are problems for real solution, such as dust protection and artistic body lines, which make for easy sales.

Since the cyclecar movement had its beginning from a tandem seater, the Bedelia, this type will be discussed first.

The Tandem Seater

The argument against tandem seating, as stated, is one of unsociability. England made a great mistake when she dubbed the side-by-side seating cyclecars "sociable seaters" for this implied an unsociability for tandems which has killed that type abroad. A properly built tandem body can be as sociable as any type, though many which have not been

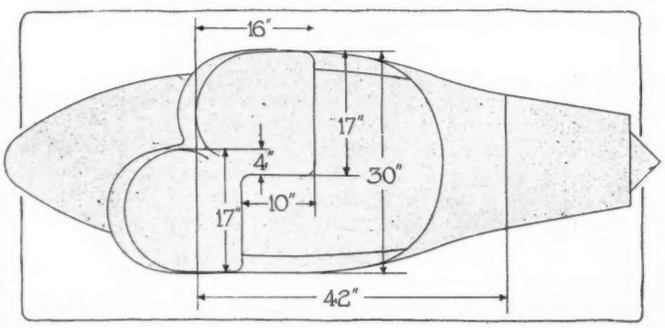


Fig. 2—Car with staggered seats, the widths being reduced to 30 inches. The sociability of the side-by-side seater is retained, yet it has only slightly more wind resistance than the tandem

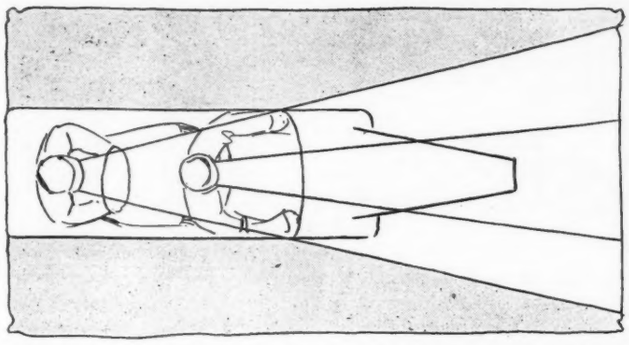


Fig. 3—Rear-seat drive prevents the use of top and side curtains, on account of the restriction of vision

built with this idea in mind are not. How then can a tandem-seating body be made sociable? How can maximum comfort be obtained from this type with maximum efficiency?

In the first place the weight must be as low as possible, this meaning that the passenger weight must be low hung also. This low weight is desirable for several reasons.

First the lower the weight center the less power is needed to propel the car on rough places; second, the lower the riders the more protection from dust they will have with minimum height of sides and thus weight of car. A cyclecar must have better dust protection than a big car, and use every advantage to that end. Third, the lower down the riders are, the less danger there is of skidding or overtrning, and the safer the feeling in the car. This safe feeling is due largely to the absence of side roll, as when road inequalities make the car roll or rock the riders merely pivot in their seats and are not thrown from side to side.

This is also one advantage of the tandem over other seatings, that the riders are sitting on the pivotal line and hence get a minimum of vertical jar.

Low Seating Necessary

Aiming then for low weight as the basis of comfort and efficiency the front rider, or driver, must be seated low. His seat should be as low to the floor as is consistent with comfort, and is shown in Fig. 4 as being 10 inches from the floor. Seated thus there must be a support for the knees or the legs will tire, so that the seat is made 16 inches long and slanted to support the rider under his knees. For the ordinary person about 42 inches is allowed from footboard front edge to the back of the seat, though with the low seat this length must be adjustable. The height of the seat back should reach to the shoulder blades and be at least 16 inches.

The rear passenger might be seated the same way, but this would bring him or her too far away for conversation. Also the rear seat should be a trifle higher than the front so that vision will not be hindered. By making this seat higher this vision is given and the seating position is raised enough so that the legs can remain vertical as shown, with the feet resting on the floor under the front seat. This is the greatest objection to building the transmission under the front seat, that it hinders the sociability by keeping the riders farther apart. By having the rear seat 10 to 12 inches high to the top of the cushion the rear rider has comfort, and yet is near enough to talk. The back of the rear seat should be almost vertical, and 16 to 18 inches high. The seat need not be over 14 inches deep, but at least 18 inches wide. The body should be not less than 22 inches wide.

The bottom of the car should be the floor board, and there should be no machinery exposed below. The clearance should be about 9 inches, for the usual 36-inch tread used with tandems.

The Side-by-Side Arrangement

With side-by-side seating the same item of low weight comes in, as a matter of efficiency, from several standpoints. In the first place the lower the weight the less the road resistance. Again, the lower the mass the less the wind resistance, and this, in the side-by-side type, is especially important. To build a side-by-side car aiming at motor car appearance is likely to make the public view the machine as a toy motor car instead of a new vehicle, so that the low-hung weight will give a new psychological impression, and a new appearance proclaiming a new type of vehicle.

For comfort the seats of a side-by-side should be from 36 to 40 inches wide, preferably the latter. To put this width on a 36-inch tread is a problem, except for good roads, though some have succeeded in it. As a rule a 40 or 42-inch tread is used, while some have gone as wide as a 50-inch tread, but mostly those in the small car class with bigger motors than the cyclecar allows.

The seat should be about as high from the floor as the front seat of the tandem before described, as in Fig. 1, and the floor straight as before also, with about the same road clearance. This will allow of a cowl, like on the tandems, which comes up high and hence which can protect the riders with a very small windshield, having little wind resistance. The frame can be narrow or triangular, with the point toward the front, and the seats overhanging, but a problem with the side-by-side is to get good dust protection, so that no construction should be taken which does not allow of high sides. The seat, to support the knees, must be deep as before, and well upholstered. The front room can be narrowed down if desired to point the car up front and lessen head resistance.

Staggered seating takes a half-way course between the tandem and side-by-side seating arrangements, and is rapidly gaining in favor. As before, the idea of keeping the weight low is of maximum importance and the seat heights should be carefully considered.

Driver Generally at the Left

The driver's seat is generally placed on the left side, as on the Falcon, and the passenger's 8 to 12 inches to the rear and set in toward the center, Fig. 2. In this way the entire width of the seating arrangement need not be over 30 inches and plenty of shoulder room still will be provided. The seats should not overhang the body in a way to interfere with sides being fitted for dust protection.

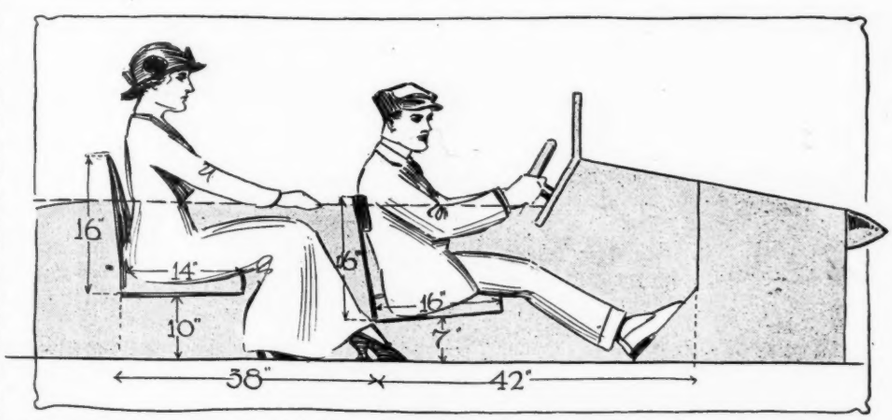


Fig. 4—Typical dimension of tandem, for sociability. Foot space for the rear passenger is provided under the front seat

The Rostrum

Makers' Timing Wrong for Low Speeds

¶ In this article we have a car owner stating that in his experience he has found that the efficiency of his car could have been increased with the timing designed for a slower speed. Is this in line with the experience of others?—Editor.

EDITOR THE AUTOMOBILE:—I was very much interested in your article on valve timing last week and as a car owner who has had experience with various cars would like to express some opinions gathered during the past few years.

I have found a tendency on the part of many of the makers to set the valve timing as if the car were to be driven at top speed during the major part of its career. Instead of designing the timing for what might be called the cruising or touring speed it is laid out with the idea of getting the greatest possible maximum speed. This is incorrect practice as it will be found that the average car is driven practically all the time at a speed of from 15 to 25 miles an hour.

Instead of setting the valve timing when the engine is turning over at a speed of 1,800 revolutions per minute, it would be far better if the timing were designed for 1,000 revolutions per minute. The result would mean money in the pocket of the average car owner because it would mean a more economical car at the speed at which he drives.

When the valve timing is set for the extreme high speeds there is a tendency on the part of the designer to set the intake opening as early as he possibly can get it. He has such a short time in which to get the gas into the cylinder that it is necessary for him to keep the intake valve open during as wide a part of the timing arc as he can get away with. When he advances the intake opening he also advances the exhaust closing and the result is that the motor is poorly scavenged at the lower engine speeds.

Another point which the high-speed man sacrifices is in his exhaust opening. This he makes too early. When the motor is going at 2,000 revolutions per minute it is necessary to open the valve sooner than when going at half that speed, in order to allow the pressure to drop to atmospheric or thereabouts at the bottom dead center. When driving slowly it is not necessary to have the early exhaust opening and the result is that much of the expansive power of the gas is lost and the car loses its power to climb hills on high gear. There is no use in having a long-stroke motor if the expansion in the longer cylinder is to be thrown away through the exhaust port. It is then less efficient than the short-stroke motor because the dead part of the stroke is longer.

New York City. J. E. S.

Champions Two-Point Ignition

Editor THE AUTOMOBILE:—In the March 12, 1914, issue of your valued publication there appears on page 598 under the general heading of "Questions on Remodeling E. M. F." the query "Is successful two-plug ignition possible from an ordinary one-plug magneto?" Your answer is perfectly correct as far as the E. M. F. motor is concerned, which has L-head cylinders. Owing to the construction of this engine two spark plugs for each cylinder can only be applied by fitting them to the valve caps, where they are so close together that practically no benefit is derived from two-point ignition.

There are many L-head engines built, however, to which two-point ignition from a magneto, a dynamo-and-storage-battery ignition system, or any battery ignition system built for single-point ignition, can be applied to advantage, using in each cylinder a series spark plug and an ordinary spark-plug in series. The L-head engines referred to have a hole drilled and tapped with a standard spark plug thread in the center of each cylinder head, this hole being for inspection purposes, and being normally closed by a plug. Among the cars using such engines I may mention Cole, Oldsmobile, Jackson, and Oakland cars. When using a series plug in the inlet valve cap and an ordinary spark plug in the hole in the center of the cylinder head the spark plugs are separated far enough to give a marked increase of power, probably as much as can be obtained by two-point ignition in T-head motors.

I have used two-point ignition in an L-head motor for nearly a year now in my model 13-60 Cole six-cylinder car, which is fitted with the Delco starting, lighting, and ignition system, using series spark plugs and ordinary spark plugs

in series; so it will be seen that I am not discussing the matter from theoretical considerations alone, but also from the point of view derived from practical experience.

Scranton, Pa. J. A. GRENING.

Reader Explains Lighting Trouble

Editor THE AUTOMOBILE:—In the February 26 issue, F. A. G., of Ghent, N. Y., asked for information as to lights going out on the 1914 Overland when starter was used. If F. A. G. will simply change the two lead wires on top of the motor (the large ones which supply current to the motor), thus causing current to flow in opposite direction to the starting motor, his trouble will be overcome.

Buckhannon, W. Va. H. J. WILSON.

How to Construct an Oil Level Indicator

Editor THE AUTOMOBILE:—The proper lubrication of the motor is such an important item in successful car operation that it is of great advantage to have some sort of an indicator to show how much oil there is in the crankcase reservoir.

Fig. 1 shows a simple form of indicator that I have fitted to several makes of cars. The design is not original with me as it is used on one of the well-known makes but I have adopted it because it can be so easily applied to any car.

The filler tube is cast from any convenient material and then a hole is cut in the crankcase and the tube brazed in. A small spun brass float is used and an indicating dial is constructed by noting the positions of the top of the indicating rod when the reservoir is empty and full.

Kokomo, Ind. F. E. M.

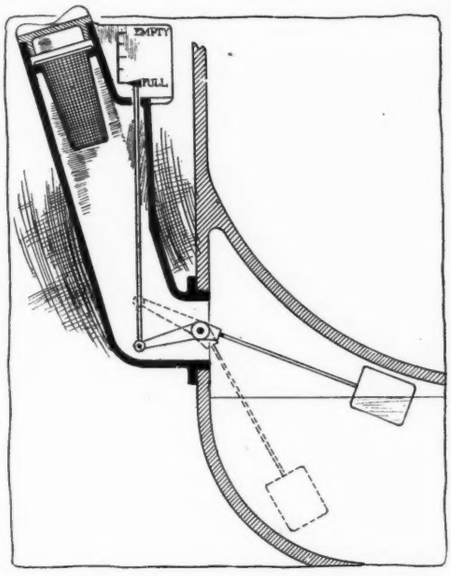


Fig. 1—Crankcase oil level indicator constructed by a reader

Why Planetary Gears Are Noisy

Editor THE AUTOMOBILE:—Please explain why the gears in a system of planetary transmission seem to make excessive noise, especially when runing in the low? The gear train is always in mesh and should run true and smoothly.

Vallejo, Cal. S. A. COPPER.

—The noise of the planetary transmission is mainly due to the fact that there are more gears in mesh with this system than with the sliding gear design. On intermediate speeds, the latter has four gears engaged, while with the former there may be as many as twelve, all of which are continuously in mesh. Therefore, assuming equal workmanship, material and design, the planetary system must make approximately three times as much noise as the sliding gear type. However, as a rule, the latter is made of better material, finished more carefully and the parts are made stiffer, and for this reason also the planetary transmission makes more noise.

Motor Backfires on Hills

Editor THE AUTOMOBILE:—We have a truck which has been giving the writer a little trouble to get properly adjusted. It works fine on level ground, either empty or with load, throttles down and never misses when standing still. On a hill it will run until the motor begins to slow down and will then back-fire and unless the gear is shifted will stop. This I cannot understand, as when running on the level at the same speed or less, at which the back-firing begins on a hill, the motor never misses. The wiring and spark plugs seem to be right and I have adjusted the carbureter several different times and still have the same trouble.

Somerset, Ky. ROY J. DANIEL.

—The fact that your motor backfires shows that the mixture is too weak and since it does this only when climbing a hill the trouble can not be due to improper carbureter adjustment. Either the float sticks against the side of its chamber and thus shuts off the flow of gasoline or it may be that the gasoline tank is so placed with reference to the carbureter that the fuel will not flow readily when on a hill.

Overhauled Motor Knocks Badly

Editor THE AUTOMOBILE:—I have torn down my machine twice, looking for a knock. Every bearing in it is in perfect shape, no carbon, not too rich a mixture, timing not too early, none of the rings loose. I cannot hear the knock until I get up to about 20 miles an hour and when I get to about 35 or 40 the engine seems as though it were coming out.

Charlotte, N. C. Z. T. S.

—A knock such as you describe is sometimes caused by a loose flywheel. If the flywheel is bolted to a flange on the crankshaft see that all the bolts are tight. If it is keyed on, see that the key fits properly and that the nut holding the flywheel is tight.

Another possibility is that one of the supporting arms of the motor is loose at the point where it is attached to the frame. This can be easily determined by inspection.

The knock is so severe that there is little possibility of it being caused by an improper mixture, a loose camshaft bearing, or some other minor derangement, yet if the knock persists it would be well to look over these details. It sometimes happens that a bad mixture will cause a very metallic knock. This is very often true of a lean mixture when the car is being driven at a fair speed with open throttle.

Sometimes a knock will appear to be in the motor when it is really in the gearset. This is especially true when a unit power plant is used. Therefore, after going over the motor carefully the gearset should be inspected for worn bearings.

Breaker Points Need Smoothing

Editor THE AUTOMOBILE:—I have a 1911 touring car which has given me splendid service so far. Last summer it began to get a little bit of misfiring trouble when the engine was raced up. I have a Schebler model F carbureter and a Splitdorf model F magneto. I had the carbureter overhauled by the Schebler people and put in first class shape. It is an original lift needle type I received four different needles of different tapers to be used in case one or the other was too blunt. My platinum points seem to have a good contact but they do not hit square. I put in new spark plugs without result. It is the same on battery as on magneto. I had all the valves reground and the engine overhauled. If I short circuit some of the plugs she will run on the remaining plugs. One of my cylinders is grooved but when warm seems to have good compression. By testing the plugs one by one they seem to have a good and rich spark. The engine runs good and does not miss when running about 15 miles an hour or less. Would like to have your opinion about this matter.

Kutztown, Pa. J. F. A.

—Your trouble is probably due to the worn condition of

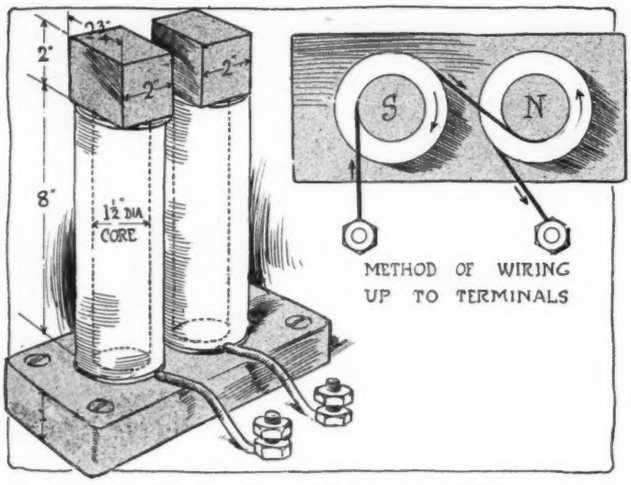


Fig. 2—Sketch showing the construction of an electro-magnet for recharging magneto magnets

the breaker points on the magneto, although after these are fixed up, if the trouble still persists, the other parts of the car will need to be inspected. The points should be smoothed off with a fine file or with emery cloth until they meet squarely. Then they should be adjusted so that the gap between them is 1-32 of an inch when the cam is off of the breaker arm roller. A special tool is provided by the Splitdorf company for making this adjustment. If the gap is more than this amount the motor will miss at slow speeds or possibly not run at all; on the other hand if the points are too close it will miss at high speeds.

Maximum Speed of 1911 E. M. F.

Editor THE AUTOMOBILE:—1—What is the maximum speed of a 1911 E. M. F. 30, the rear axle ratio being 3.25 to 1?

2—Could I get more speed by attaching a modern carbureter?

Langdale, Ala. J. MCCLENDON.

—1—The maximum speed of this car is about 50 miles per hour, depending on the car adjustment.

2—The carbureter fitted to this machine was designed especially for it and there is no reason why it should not produce the maximum speed the car is capable of.

Making Magnet Recharging Apparatus

Editor THE AUTOMOBILE:—1—Will you please describe in detail how to make a pair of electro-magnets for use on a 110-volt circuit for recharging magneto magnets?

2—How is this apparatus used?

York, Pa. A. W. ALLEN.

—1—A pair of electro-magnets for remagnetizing magneto magnets is shown in Fig. 2. The apparatus consists of a cast iron base plate 1 inch thick on which are mounted the magnetizing coils. Each coil is made by winding 7,150 turns of double cotton magnet wire, No. 24 gauge, on a wrought iron core 1.5 inches in diameter and 8 inches long. On the top of each core is placed a wrought iron block 2 by 2 by 2.75 inches. When the coils are finished they should be covered with a good insulating tape such as Empire cloth and then shellacked.

Care should be taken in winding the coils to see that the two are wound in opposite directions so that the top of one will be positive and the other negative.

The winding of the coils is a tedious process by hand and therefore it is advisable to employ some method that will permit the work being done more expeditiously. If a lathe is at hand the simplest method is to put the core between centers after fitting thin plates to the core ends to prevent the wire from slipping off. The lathe is then started and all the operator has to do is guide the wire, taking care that it is evenly distributed over the core. If a lathe is not available, a stand can be made which will take the place of the lathe.

2—The magnets are recharged by moving them back and forth over the core ends a number of times.

Where to Obtain Steam Car Parts

Editor THE AUTOMOBILE:—1—I would like to know where the Stanley steam car is built?

2—Could you inform me where I could get in touch with manufacturers of steam motor car outfits such as boilers, engines, etc.?

Bisbee, Ariz. C. R. REAMER, JR.

—1—The address of the Stanley Motor Carriage Co., is Hunt St., Newton, Mass.

2—Steam boilers can be obtained from August Oldfeldt & Sons, Valley Stream, N. Y.; F. W. Oldfeldt & Sons, Nyack, N. Y., and the Steam Carriage Boiler Co., 130 W. First street, Oswego, N. Y. Steam engines from the Dieter Steam Engine Co., 123 Liberty street, New York City, and F. W. Oldfeldt & Sons. Steam condensers from the A. & Z. Co., 530 W. Fifty-sixth street, New York City.

Questions on Motor Construction

Editor THE AUTOMOBILE:—1—What is the proper length for the connecting-rod on an automobile motor in proportion to its stroke?

2—Give me the proper valve timing where highest efficiency, power and economy is desired in a touring car?

3—What is the cause of back pressure at the end of the power stroke? Explain this fully.

4—Will a six-cylinder car, having the same horsepower and weight as a four, run as economically as a four, both cars being of equal quality and design,

5—At what point in the power stroke do gases exert the most power?

6—Will a 3.5 by 5-inch cylinder give as complete combustion to the gas as though the stroke were increased to 6 inches and bore reduced to give same piston displacement?

7—Would not an automobile cylinder that was capable of 75 pounds compression show more power and economy than one having only 60 pounds compression?

8—Is there any advantage in offset cranks? I want actual existing conditions and trust that you will reply fully.

Heemer, Neb. GROVER SHARP.

—1—Making the connecting-rod about twice the length of the stroke, is considered good practice. If it is made longer than this the overall height of the motor becomes too great, while if it is made less the angular thrust of the rod on the piston causes an undesirable amount of wear.

2—It is impossible to give a valve timing that will be found best on all motors because this depends on the design of the individual motor. Furthermore greatest power, economy and efficiency are not compatible. The valve timing that will give greatest power will not give the greatest economy, at ordinary road speeds.

The best timing to use, is the average of that found on the principal makes and this was given in a story on valve timing that appeared in the March 19 issue of THE AUTOMOBILE. The average timing is as follows: Intake opens 11.5 degrees after upper dead center; intake closes 35 degrees after bottom dead center; exhaust opens 50 degrees before lower dead center and closes 9.2 degrees after top dead center.

3—Back pressure at the end of the power stroke is due to the fact that the stroke of the piston is not made long

enough to expand the gases all the way to atmosphere.

As a rule the term back pressure is applied to the exhaust stroke. Back pressure on the exhaust stroke is due to the frictional resistance offered to the passage of the exhaust gases from the cylinders to the atmosphere by the exhaust valves and ports, by the exhaust pipe and by the muffler. Therefore, when the exhaust valve is opened, instead of the pressure immediately dropping to atmosphere, as would be the case if there were no resistance, it remains a certain amount above, depending on the resistance offered by these passages and the amount of power the engine is developing.

Excessive back pressure is caused by valves that are too small, by small passages and by the muffler passages being clogged with dirt and soot.

Economy of Six and Four About Equal

4—Whether the six or the four is more economical is a question. The four has the advantage of fewer parts, which would tend to reduce its mechanical losses a certain amount and the surface of the combustion chamber of four cylinders of a given volume is less than six of the same volume, and this should give the four a slightly increased thermal efficiency. On the other hand, in favor of the six, it is argued that less gear changing is required because the torque is more even and therefore that a six will climb hills on high gear that a four might be required to take on second. As a certain amount of power is lost in the gearbox when intermediate speeds are used, and since if a car can climb a hill on high it will be operating at nearer its maximum efficiency than if it climbs on second, because the throttle will be opened wider, the compression will be greater and greater compression means greater efficiency, it is claimed that the six is at least equal, if not superior to the four, in economy.

5—Using the word power in its strict sense, it is difficult to say just when in the power stroke the gases exert the most power. Power is defined as the rate of doing work and is expressed, usually, in foot pounds per minute; therefore, to determine at what point in the stroke the greatest power is developed it is necessary to know at what point the pressure on the piston multiplied by the distance it moves in a given increment of time is a maximum. Without knowing the pressure at the different points in the stroke, however, it is impossible to say where the maximum power is developed. This point should be somewhere near mid-stroke.

Power Used When Pressure Is Meant

The word power is often used when pressure is really meant, and it may be that this is the meaning you attach to this word. Maximum pressure is developed at or near top dead center depending upon the setting of the spark; if the spark is greatly advanced the pressure may rise to its full value before the piston reaches dead center, while if retarded, maximum pressure may occur after the piston has started on the expansion stroke.

6—The cylinder with the 5-inch stroke should give just as complete combustion as the one with the 6-inch stroke, because, in either case, the combustion should be completed in the first part of the stroke, providing the mixture is correct and the spark properly set.

7—Yes. A motor with 75 pounds compression will give more power and show better economy than one with 60 pounds compression. But most designers believe that the advantages thus gained are not great enough to offset the disadvantages. The higher compression motor is harder to crank, will not throttle down as low, requires a larger cooling system and is more liable to knock when the cylinders become carbonized. This is why the average motor of today has a compression of about 60 pounds instead of 75, although a few years ago the latter figure was more common.

8—Whether offset cranks are to be preferred is a question. Those in favor of this construction claim that it decreases the wear on the piston and cylinders and lessens the friction between these parts, due to the fact that the angularity of the connecting-rod on the explosion stroke is less than when the crankshaft is on center. Since greatest pressure is developed in the cylinder on this stroke it is considered an advantage to reduce the angularity on this stroke, although by so doing it is increased on the up strokes. It is obvious that by reducing the angularity the side thrust of the piston is lessened, and as the pressure on the explosion stroke is approximately three times what it is on the compression stroke it is deemed advisable by many designers to reduce the angularity on the down stroke at the expense of increasing it on the upstroke. These advantages are questioned by a great many engineers.

Discussion of Variable Stroke Motor

Editor THE AUTOMOBILE:—Will you please give me your opinion on my four-cycle variable stroke motor, Fig. 3. A vertical section through the cylinders is shown at the left and diagrams showing the extreme positions of the mechanism are given at the right.

Looking at the left illustration, it is seen that the crankshaft is located to the left of the cylinders and about on a level with the lower ends of the connecting rods. The motion from the connecting rod is transmitted to the crankshaft through the secondary connecting rod A. The connecting rod is constrained by the rod B which is pivoted at its lower end C. The position of this point C determines the length of the stroke as will be seen by referring to the diagrams at the right; the upper one shows the position of this point for maximum stroke while the lower one shows it for minimum stroke. In each case the positions of the linkage for the extremes of piston travel are indicated. The movement of the point C is accomplished by attaching it to the sector which is pinned to the cylinder casting at D. Movement of this sector is accomplished by the worm that meshes with the periphery of the sector.

Philadelphia, Pa. J. P.

—Variable stroke motors offer many advantages over the constant stroke type but they have never come into general use because of the extra size, weight and complication.

A study of your engine shows that three extra bearings per cylinder are required, and besides a worm and sector is needed for shifting the linkage. This means complication and increases the cost of manufacture. Also this design calls for a bulky crankcase construction and this means added weight. The worm and sector does not permit the changing of the stroke quickly enough to keep up with load changes under all conditions.

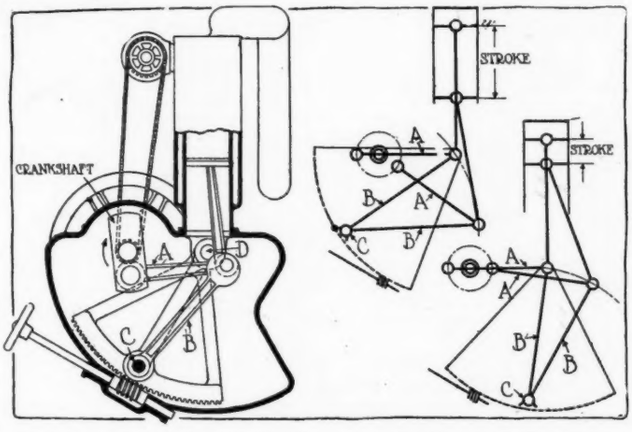


Fig. 3—Variable stroke motor. Left—Vertical section through cylinders. Right, top—Position of mechanism for maximum stroke. Right, bottom—Position for minimum stroke.

Baker Brings Out Electric Roadster

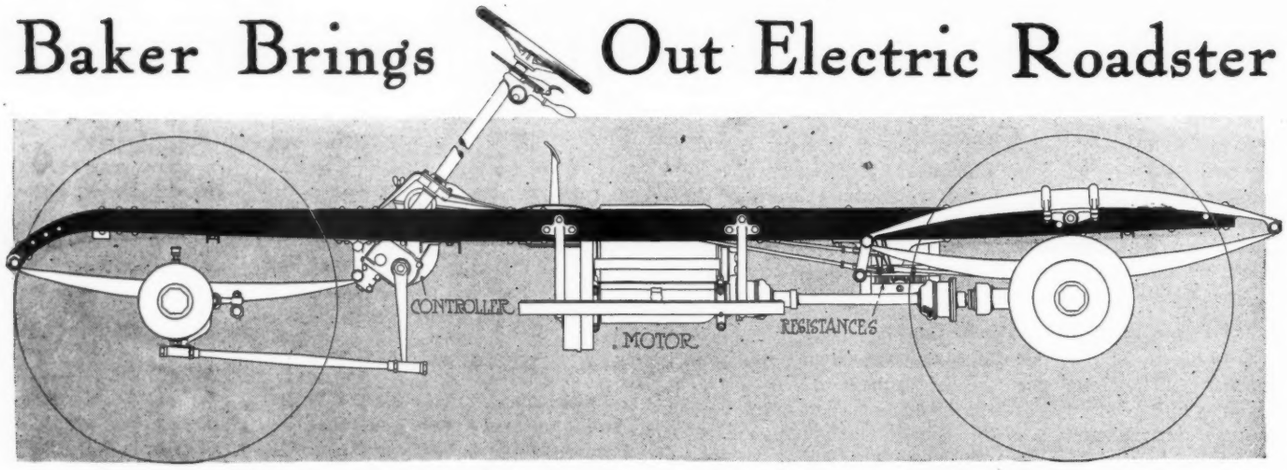


Fig. 1—Side view of the Baker chassis showing disposition of the power and control units and special rear suspension

New Two-Seater Has Wheel Steer, Latest Body Lines, and Is Capable of Unusually High Speed

A NOTEWORTHY entry in the field of passenger electrics is the new two-passenger roadster brought out by the Baker Motor Vehicle Co., Cleveland, O. This vehicle, shown in Fig. 2, is intended to meet a demand that undoubtedly exists for an electric that looks, and is, capable of a higher speed than is customary with the electric coupé or brougham.

The factor of appearance as well as actual performance is mentioned because this is a consideration that is becoming increasingly important in these days, when the mechanical features are already advanced to a high stage of efficiency.

There has always been an air of sedateness about the average lines of electrics that fails to make any strong appeal to the automobiling man. There are not wanting women, too, who prefer a vehicle with a higher turn of speed, though they are satisfied with electricity as a means of propulsion. It is not so much an increased speed out in the open that is desired as the enormous advantages which the faster car has in traffic driving. All automobilists are aware of the great saving of time through traffic if the car is capable of those spurts in tight situations which allow one to keep going. It is the stops which are annoying to the keen driver, and this is a particular in which the electric has not heretofore shown up to advantage.

Fig. 2—The latest Baker electric fitted with wheel steer

The new Baker roadster is capable of a higher speed than is usual with the eleectric vehicle. Its appearance is also designed to make a strong appeal to the automobilist of either sex who wants a vehicle that is built on longer lines and in a word is not so markedly "electric."

The battery is disposed fore and aft as in the usual practice, but on account of the cowl dash an additionally graceful appearance is produced at the front by the effect of continuity given to the sloping line of the hood.

Another step which adds considerably to the appearance of the new model is the introduction of flanged steel fenders. The eye, after years of training on the gasoline car body, has come almost to demand a fender that shows a better proportional fit to the other body parts than does the flat leather type that has been carried over from the horse carriage to the electric vehicles.

While treating this matter of appearance it may not be out of place to point out that the wheel form of steering is coming into more general use on electric vehicles. As far as ease of steering is concerned there cannot be much to choose between the lever and wheel, many claiming the former as the more suitable method. But here again the looks of the thing are not to be ignored and most drivers of gasoline cars show an inclination to continue with the wheel for steering. In the Baker roadster wheel or lever steer is optional.

Mechanically there is no alteration, the chassis Figs. 1 and 4 being the same as used on the coupé model this year and last. The side members are perfectly straight in plan. The motor is supported on the three-point suspension principle, two of the brackets being bolted to a short central longitudinal member and the third to the side member of the frame. Both motor shaft and counter shaft, Fig. 3, are mounted on annular ball bearings. Lubrication is effected by packing with grease, one filling lasting an entire season. The casing in which the chain runs is dust-proof and the chain operates in a bath of oil.

Drive is by silent inclosed chain to a counter shaft mounted alongside the motor casing, and thence by a straight line transmission to the rear axle through two universals. The final drive at the axle is bevel. The ratio from motor to wheels is 12:1. The suspension is by 34-inch semi-elliptic springs in front and 40-inch full rear elliptics. The rear springs differ from ordinary gasoline car practice in that the front end is shackled in such a way, Fig. 1, that the springs themselves act as the radius rod obviating the need for a special member for this purpose. In order that this action can take place, the upper half of the spring is attached pivotally to the side member.

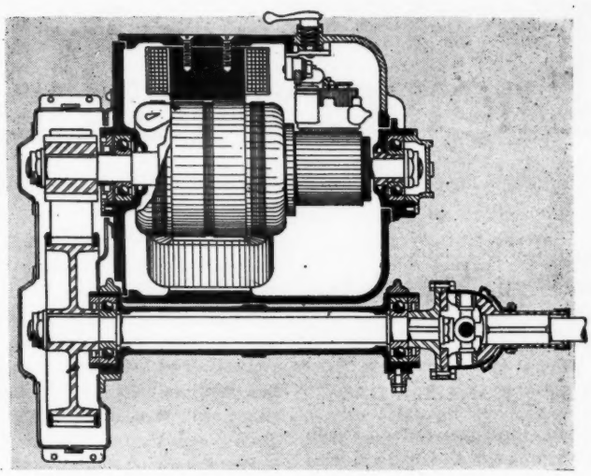


Fig. 3—Sectional plan of the Baker power plant, showing chain-driven counter shaft arranged at side of motor

The controller, which is operated by the short lever located on the steering column under the wheel, is of the drum type. It is situated under the foot board and connected by bevel gear at the base of the steering pillar. The resistances are of the cast grid type, suspended from the frame behind the motor. All wiring is heavily insulated and wherever it passes through the frame rubber bushing is inserted.

Series wound motors are used on the roadster and each one is subjected to severe tests both before and after installation in the car. These tests include, first, a load test in which a current of 100 amperes is passed through the windings for 15 minutes; second, an efficiency test on the brake to obtain the electrical and brake horsepower. Then follows a test in which the motor is mounted in a running gear apparatus that provides conditions equivalent to those met in actual practice on the road, braking, etc. Finally, after installation the motor and transmission are tested on a machine which records the equivalent speeds in miles per hour at the various stages of control.

This machine consists of wooden drums mounted under the floor so that a small portion of the circumference projects slightly above the surface. The driving wheels of the vehicle under test are supported entirely on these drums and recording instruments attached to the latter permit of accurate readings being taken as to speeds of the finished car. For the purpose of bringing the test up to actual working conditions the interior is loaded with weights representing average passenger load. The battery also is represented by a "dummy" set of weights placed in the battery box. Careful tabulated records of all these tests are kept for future reference.

Pneumatic Tires Are Standard

Aluminum panels are used for the body construction. The wheelbase is 88 inches and the tread 50 inches. A 34-cell Exide battery is standard. Pneumatic tires 32 by 4 inch are fitted to front and rear. Other details of the equipment include a collapsible Pantasote top, curtains, folding windshield, head and side lamps, voltmeter, ammeter, odometer and kit of tools.

Painting of the bodywork is blue with gray striping as standard. The metal finishings are in nickel. The price is $2,300. Great care and attention have been given to the general finish of the car, not only in regard to artistic appearance and comfort for driver and passengers, but also in respect to those little refinements in construction which make for solidity and durability.

Gasoline Law Violation Stirs Inspectors

MILWAUKEE, WIS., March 21—The Wisconsin state oil inspection department is up in arms as the result of the decision of Judge Page of district court dismissing a complaint against the Bartles-Maguire Oil Co., of Milwaukee, which is alleged to have delivered gasoline in a container that was not painted red and did not have "gasoline" painted on the side. The company contended that the delivery can was not a storage can, but was used merely to transport a small quantity of gasoline from a tank wagon to a private can used, by the family receiving it. The law is strict in its requirement that any container used for gasoline at any time must be painted red and marked properly. The state oil inspector states that the violation was clear and while it is not the intention of the department to oppress the Bartles-Maguire company by court action, it is trying to establish the principle of the matter.

WASHINGTON, D. C., March 21—A Washington section of the Electric Vehicle Association of America has been formed with the following officers: Chairman, E. S. Marlow; vice-chairman, R. B. Emerson; secretary-treasurer, C. M. Marsh. Monthly meetings will be held.

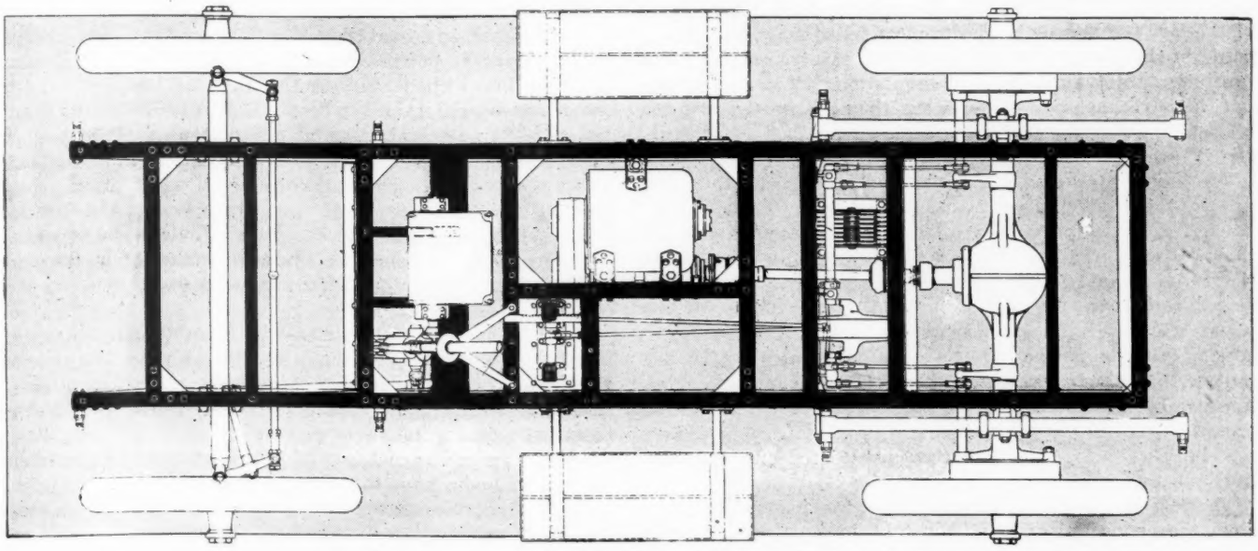


Fig. 4—Plan of the Baker chassis as fitted for wheel steer. This chassis is used on all models

The Engineering Digest

Light Pistons Highly Desirable—But Cast Iron Remains Best Material According to Lacoin's Reasons

A SUBJECT TO BE LOOKED AT FROM ALL SIDES

PROMINENT mention given to improvements in the manufacture of aluminum pistons by the radical element of the French automobile press has apparently induced those representing more conservative views to show the possibility which exists for defending and preferring the standard material, cast iron, and for giving due consideration, as well, to piston pressed from sheet steel with or without the assistance of autogenous welding. The results accomplished with aluminum pistons and arguments in their favor were related in these columns in the issue of March 12. Other views covering the subject more broadly are voiced by Louis Lacoin and are given in substance in the following, with omission of an introductory explaining the importance of reducing the weight of pistons to a minimum.

The reduction of piston weight can be effected in four different ways. (1) A type of motor can be used calling for pistons whose dimensions are reduced; (2) the pistons can be designed and machined so as to reduce useless material to a minimum; (3) a light metal, such as aluminum, can be employed; and (4) a metal of very great strength can be used, pared down to the smallest section.

These methods may be combined in greater or lesser degree, and it is by combining them that the very lightest pistons are obtained. Some consideration may be given to each of these methods separately.

(1) *The technical method.*—The diameter of a piston is determined by the bore of the cylinder and its length by the number of piston rings and the lateral thrust from the connecting-rod. In the case of a motor which is to be of a given power and whose maximum number of revolutions is decided in advance, the reduction of the piston diameter is obtained by lengthening the stroke of the motor. As the experience of the last few years has shown most felicitously, the lengthening of the stroke does not necessarily involve a corresponding reduction in the number of revolutions. The first step to get the advantages of light pistons thus consists in adopting a lengthened stroke, up to the limits prescribed by the constructive possibilities.

The number of piston rings must be sufficient to secure gas-tightness. Well-made rings, ground to fit in the grooves as well as the cylinder wall, admit of gas leakage only where they are split. To reduce this leakage, the splits of all rings should be located in the plane in which the connecting-rod moves, so that the piston, leaning against the cylinder in this plane, will cover the split completely. As the piston leans now to one side and now to the other, two rings at least are wanted, and they should have their slits at opposite sides. The use of more than two rings should be superfluous and necessarily means increased length and weight of the piston, especially as the place where they are located must be relatively heavy.

The rest of the piston serves to resist the oblique pressures from the connecting-rod and must be long enough for this purpose. In order to obtain good lubrication the area and shape of this portion must be proportioned according to the pressures to be resisted. In designing the motor, all that is possible should consequently be done to reduce the oblique thrust, this in turn rendering possible a reduction of the piston areas in frictional contact with the cylinder. The reduction of lateral thrust gives, however, only an incomplete result unless the remaining thrust is applied at a point of the piston from which it can be distributed as evenly as possible over the entire friction area. A poorly distributed stress produces exaggerated local pressures, by which the oil is squeezed out in some places while other portions of the piston surface fail to touch the cylinder and afford no support. As the space occupied by the rings is not included in the area of support, calculation would indicate that the axis of the piston pin should be nearer to the lower edge of the piston than to the head.

(2) *Elimination of useless material.*—In all pistons which are cast in a mold the soundness of metal must ordinarily be safeguarded by having the cross sections in the unfinished

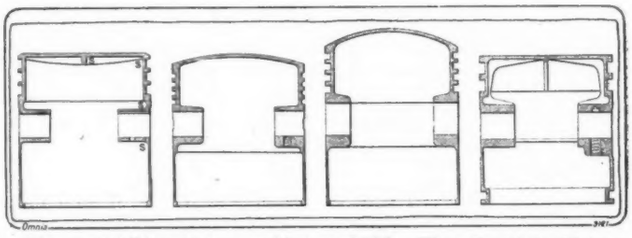


Fig. 1—Schildge piston, welded at SSSS. Figs. 2 and 3—Pistons pressed from sheet steel. Fig. 4—Binet cast-iron piston, cast with sections of metal down to 1.8 millimeter

casting exceed those which would be required for strength by several millimeters and paring down the surplus metal afterwards. Unfortunately, however, a cast piston cannot be turned or ground down internally between the piston pin hubs and the head except at a prohibitive cost, and cast-iron pistons have for this reason so far always had surplus metal and weight in this place. [It is here mentioned that the firm of Binet has succeeded in producing cast-iron pistons, by means of a special composition of metal and mechanical molding, in which a uniform thickness as low as 1.8 millimeter can be maintained, where this is required, without any but external machining or grinding, the irregularities, if any, coming on the outside, and that this special cast iron has a strength 40 per cent above normal while sharing with that of standard pistons in the properties—small friction and wear when working in cast-iron cylinders—by virtue of which cast iron became the preferred material in the first place. Fig. 4 shows one of the Binet pistons made by this process.]

(3) *The use of a light metal.*—By suitable alloys of aluminum, by which its hardness is considerably and its specific gravity only slightly increased, and by providing internal ribs to strengthen and stiffen the head, it has been found possible to make aluminum pistons which weigh only about one-half as much as cast-iron pistons of corresponding dimensions. No doubt, none but aluminum pistons would therefore be used if most constructors did not find objections to them which are more or less justified. They fear wear, mashing of the metal in the piston ring grooves and especially softening of

the head, since the fusion point of aluminum is much lower than that of cast iron. The advocates of aluminum pistons retort that wear can be offset by a slight lengthening of the wearing-surface, that there is no mashing of metal in the grooves if the rings fit properly and that the heads show no harmful effects of the heat if thickened and strengthened by ribs.

What is necessary is thus not simply to replace the cast-iron piston with one of aluminum but to design a special piston for this metal and to revise the plans of the motor, since the lengthening of the piston changes the compression.

(4) *The use of metal of great strength.*—Other inventors have turned their efforts in the opposite direction. On the theory that steel would permit a radical reduction of all sections and thereby reduce weights, they have resorted to this material although its specific gravity is somewhat greater than that of cast iron. As steel is at least six times stronger than cast iron, the reduction would indeed be marvelous if it could be made in this proportion all over. But difficulties of manufacture, as well as those relating to rigidity, intervene. In some cases the sections can only be reduced two-fifths in practice. The lower portion of the piston, for example, is in cast iron only 2 millimeters thick. In steel it should be only 1/3 of 1 millimeter thick, on the plan of a mathematical reduction, but such a film could not be machined. The difficulties at this point have led to three distinct methods for making steel pistons. The cast-steel piston, the pressed-steel piston and the autogenously welded piston represent these varieties.

Three Kinds of Steel Pistons

Cast-steel pistons cannot be cast much thinner than cast-iron ones and, while they can be machined down somewhat thinner, the gain is not more than 20 to 25 per cent. In return for this advantage it is necessary to accept the higher friction which goes with the use of steel rubbing against cast-iron cylinders and also a more rapid wear of the pistons. The higher friction means reduced power at the same number of revolutions, as compared with cast-iron pistons, and, while the power may be regained by the higher motor speed which the reduced weight would make possible, this would be offset by smaller fuel economy. With regard to the wear, it is understood that it is the steel which wears most when both metals are hot, and, on the other hand, it is not known that the cylinders would wear less than with cast-iron pistons. On the whole, the chance of popularity for cast-steel pistons seems remote.

The prettiest steel pistons are the pressed ones. They come from the dies practically in their final shape and very thin. The finishing of the working surfaces demands special care, however. On account of the thinness of the metal it is necessary to support it exteriorly when it is being machined interiorly, and *vice versa*. Each piston must be very accurately alike to every other piston in order to have them all fit without special adjustment on the same face plate or chuck.

For manufacture on a large scale this method is perhaps the best of all. As pressed-steel frames have ousted all other kinds, the pressed-steel pistons may eventually drive other types from the market. It would be necessary, to this end, however, that some manufacturer made a specialty of this line as others have made a specialty of carbureters and magnetos.

Autogenous welding admits of avoiding the great difficulty of turning down very thin piston walls. Where this process is used, each portion is cut from a tube or from a sheet or is pressed into the desired shape before it is joined to the other portions. Between two successive weldings, in this form of manufacture, it is practicable to take a component to the lathe and remove the last gram of superfluous metal from it. The interior can be turned down, ribs to support the head can be added and then the hubs for the piston pin can be welded on. Almost any form can be materialized. The process is therefore specially adapted for trial motors and those of extreme speed. The weight can be as low as that of aluminum pistons.

[In order to cover the ground completely, the author should perhaps have referred to the difficulties which may arise with any piston in which the metal is of very thin section in the matter of keeping the head of the piston from becoming excessively hot. Receiving heat from the burning gases in proportion to the exposed area, the head is raised to a temperature considerably higher than it would reach if it were heavier, and the thin walls of the piston do not carry this excessive heat away with sufficient rapidity. In the motors of racing cars and aeroplanes this difficulty is remedied by a very abundant lubrication, and with aluminum pistons the difficulty does not occur in the same form, because the heat-conductivity of the aluminum is much greater than that of steel while the section of the aluminum walls is much larger, too. Another thing is that the aluminum piston may not get into as uniform contact with the cylinder walls as the steel piston, because it must be made with a greater average clearance, but on these points only practical results can speak the deciding word.—ED.]

Each of the types of piston mentioned has its advantages and its inconveniences. Some inventors have essayed to group the advantages and avoid the inconveniences by constructing pistons made in several pieces of different metals, but the results, in the matter of lightness, have not been encouraging.

Everything considered, though it is possible to manufacture pistons from other materials than cast iron and lighter than those made from this material, there is little reason for believing that their use will become general for some time to come. Improvements in the manufacture of cast-iron pistons are made every day, and this material, moreover, is the best with regard to friction and wear.

Furthermore, the need of pistons still lighter than those which can now be produced in cast iron will not be felt till the day when motor speeds twice as high as those now actually used will be demanded. When that time comes, the subject can be taken up again; fresh technical progress will then be at disposal.—From *Omnia*, March 7.

Double-Dial Speed Indicator to Help in Operating Sliding-Gears

A SOCALLED differential speed indicator recently introduced in the French accessory market is shown in Fig. 5. It comprises a Watford indicator and cyclometer, in which one hand shows the momentary and the other the maximum

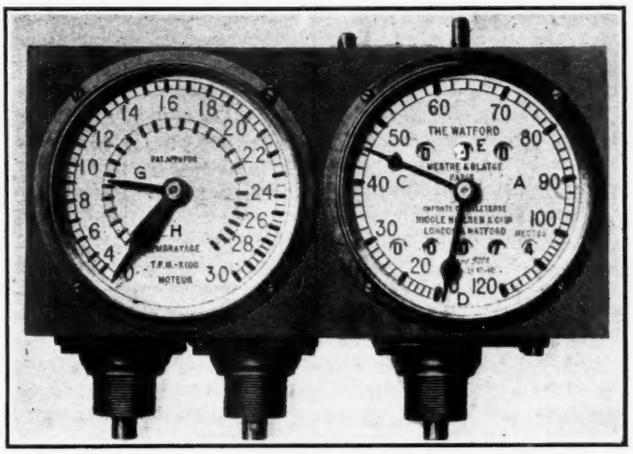


Fig. 5—Speed indicator, with special dial for showing number of revolutions of motor shaft and of gear shaft

speed and provided with the usual indications of daily and total distances, and also another instrument on the dial of which one hand G shows the motor speed and another hand H the speed of the primary gear shaft, both in revolutions per minute. To many it is a satisfaction to know how fast the motor is running at any given time, and the ability to tell the motor speed at a glance may be of special value to testers of new models at the factories. Ordinarily the two hands should be at the same place on the dial, but if the clutch slips they will of course separate, and the instrument thus tells if the clutch is acting faultily.

The principal value of this feature of the indicator lies, however, in the assistance it affords for effecting gear changes with a sliding-gear without clash. The right moment for making a change of gear is when there is no driving-pressure on the gear teeth. This condition is usually obtained by throttling the motor slightly a moment before unclutching. The motor shaft and the gear shaft will then maintain about the same speed for a few moments, although the clutch is out, and during this brief period the gear-changing should be effected. The new instrument now permits the operator to watch the two hands on the special dial and to practice such simultaneous action with the throttle and the clutch pedal that the hands will remain together while he shifts the gears. By its use he should soon become an expert.—From *Omnia*, March 7.

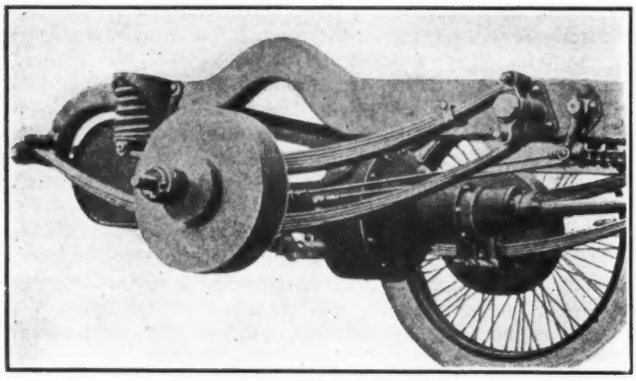


Fig. 6—Rear spring suspension for 10/30 Loeb (L. U. C.) car

Silent Valve Gearing and Compound Springs in German Car

AMONG four models turned out by the relatively young and small firm of Loeb & Co., Ltd., of Berlin-Charlottenburg, two are equipped with Knight motors and the two others with four-cylinder poppet-valve motors. In one of the latter, which is known as the 10/30 because it registers less than 10 horsepower according to the German taxation formula and 30 horsepower by brake tests, two unusual construction features are noticed. One is the noiseless valve gear which is briefly described and illustrated in a correspondence from England found elsewhere in this issue, and the other is the rear suspension shown herewith in Fig. 6.

The camshaft is driven by silent chain from the crankshaft, and the principal advantage of the gear, in addition to its silence and freedom from impact at the upper and lower ends of the tappet rod, lies in the rapidity with which the valves are opened and closed—a feature permitting the cylinders to fill up well without resorting to oversized valves or exaggerated valve lift. Naturally, the same motion producing rapid lift and closing also produces a correspondingly prolonged dwell at the full-open position.

The special spring-suspension is looked upon as an interesting innovation aiming for the neutralization of the oscillations of the main spring, so far as their effect upon the vehicle body and its occupants are concerned, by interposing two other spring elements with different oscillation periods, and one of these a coil spring.

A nearly exhaustive and largely illustrated description of the 10/30 Loeb model and some data with regard to the same company's two Knight-motor models are found in *Der Motorwagen* for February 28.

Features in Car with 4-Wheel Drive Used in German Army

SEVERAL cars with four-wheel drive and equipped with cannons, one for each car, for use against dirigible balloons have been furnished the German army administration by the firm of Heinrich Ehrhardt of Düsseldorf. The following details are given with regard to their construction:

The motor is mounted high and flexibly in the specially stiffened pressed-steel frame. It has four cylinders, 130 by 150 millimeters bore and stroke, giving 50 horsepowers, the cylinders being cast singly, T-shape. The two middle bearings of the crankshaft are mounted in the upper half of the crankcasing, while the two end-bearings are mounted in both the upper and the lower portions. Double ignition, lubrication by a force-feed circulation system actuated from a gear pump on a vertical shaft and an adjustable oil level constitute other features. Surplus oil passes through a sight glass on the dash on its return to the pump. The flywheel is cast steel, the clutch cone of sheet steel and the clutch mechanism self-contained.

The change-gear box, Fig. 7, contains below the two usual shafts a third one with a differential gear and with universals at both ends, from which the power is transmitted to the rear and the front axles, respectively. A special locking device for the three shifting-rods of the change-gear is mounted in a compartment in front of the gearbox and is shown in Fig. 8. A slit drum *b* runs on rollers *a* and grips by means of dogs *c* corresponding lugs *d* on the shifting-rods, so that never more than one of the lugs *d* comes opposite to the corresponding groove in the drum, in which position, only, the shifting-rod can be displaced by means of shifting lever *f*. When the lever *f* is displaced on its shaft *g*, the drum *b* is turned and another shifting-rod becomes free, while the one which was free before becomes locked.

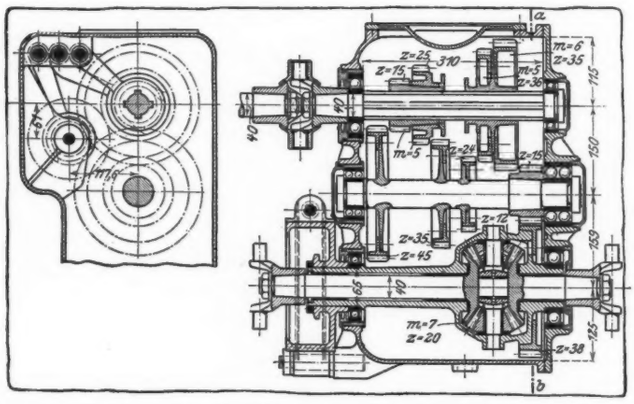


Fig. 7—Gearbox of 4-wheel-drive army car; figure to the left is section on the line *ab*

The differential gear in the gearbox takes care of differences in the speed of front and rear wheels on the same side of the vehicle. The front axle, Fig. 9, is hollow and is formed spherically at both ends. From the differential at the middle of it two drive-shafts connect with bevel-gears at the ends,

which are mounted, in the manner usual for four-wheel drive constructions, upon a vertical shaft co-axial with the steering pivot pin. The housings of these gears are protected by means of caps of spherical conformation against dust and loss of lubricant.

The rear wheel drive shafts are of the floating type. The rear wheels are built up from sheet-steel with internal wood reinforcements and carry solid twin tires. Broad sheet-steel rings are secured to the wheels to prevent the vehicle from sinking into soft ground more than the depth of the tires.—From *Zeitschrift des Vereines Deutscher Ingenieure*, February 21.

Fuel Feed Regulation Through Float Chamber to Be Abolished

ALL carbureters have one shortcoming in common. It lies in the system of regulating the level of the gasoline by means of a float, balancing levers and a needle valve. But now a new system for regulating the fuel feed has been devised and tried. A concern in Berlin [apparently a taxicab company] which consumes close to 1 million kilograms of fuel per year will be the first beneficiary, but subsequently it will be possible to apply it to all automobiles.

Such is the declaration made by F. W., whose work, he says, consists largely in maintaining and improving the fuel and working efficiency of the large number of vehicles controlled by the said concern. His observations on these points were gathered in the form of about 600 curves representing fuel consumption and car performances, in most instances for a period of twelve months and more, and the experiments from which a radical improvement finally resulted were based on these curves and the experience they represented. Without this rich and accurate material it would have been difficult to make sure of the facts, which are especially elusive in matters of fuel consumption under actual working conditions of the vehicles, as the consumption must necessarily be viewed in relation to the working conditions.

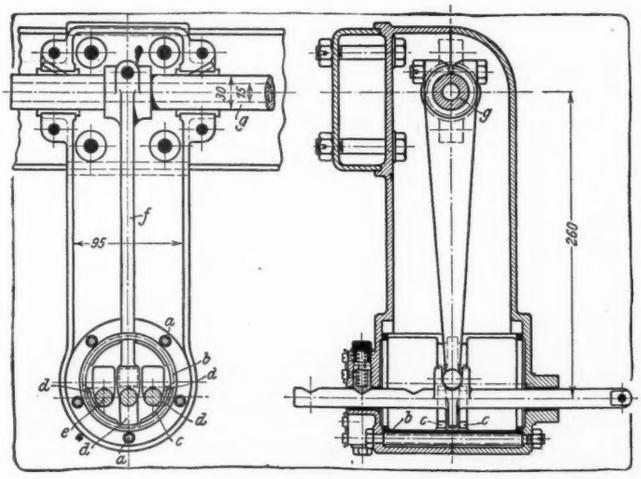


Fig. 8—System of locking gearshifting rods in the Ehrhardt 4-wheel-drive military car

Most users of utility vehicles notice that some time after a vehicle has been placed in commission its speed or working capacity decreases and that at the same time its fuel consumption increases, although it would seem more probable that fuel consumption would go down with speed.

But most people ascribe these two changes to the poorer grade of gasoline which is coming into the market or to wear of the machine.

It is not till brake tests are made with many different carbureters on the same motor and also with several apparently identical carbureters, and with many different motors as well as with motors which would be expected to be in about the same condition that the contradictory results are noted, and one's attention is finally turned toward the one cause for variations of the fuel consumption which makes itself felt throughout. A saving of 5 per cent. of the fuel for a concern using 1 million kilograms of it per year amounts to 10,000 mark, which is not a negligible sum, and thus it was naturally under these operating conditions

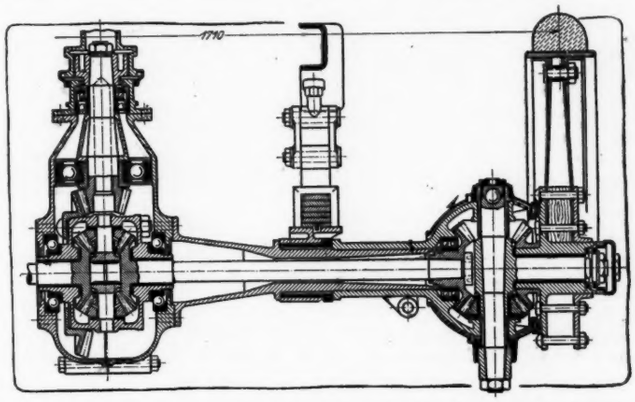


Fig. 9—Front axle drive (horizontal section) and front wheel gear (vertical section) in Ehrhardt car

that it was found that the provisions made in all spray carbureters for regulating the level of the fuel in the jet are faulty.

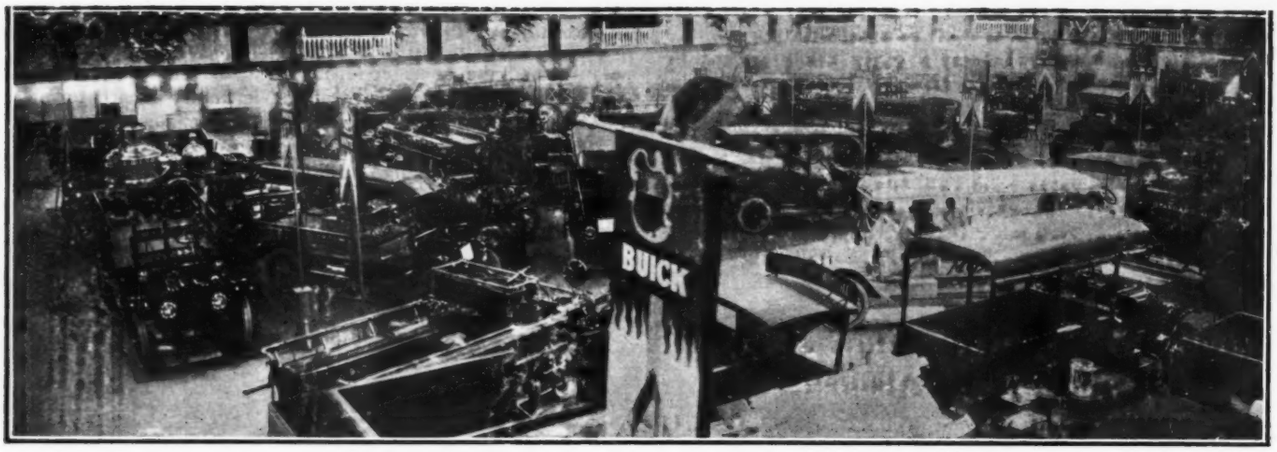
The float, the balance levers and the needle valve are parts of a certain weight and are more or less influenced by shakings and vibrations. Where the balance levers play against the float, with one end, and against the needle valve, with the other end, some wear soon becomes noticeable, and this is in even greater degree the case at the point of the needle. The pivots of the levers also become more or less loose. In course of time this wear results in making the fuel rise to a higher level in the gasoline jet, and the natural upshot of this change in the conditions is not only higher fuel consumption but also an undue enriching of the fuel mixture, causing the motor to run less efficiently.

Painstaking adjustment may remedy the fault of the mixture to some extent, but in practice such careful adjustment cannot be undertaken, and as a rule it cannot equal the adjustment given with the gasoline at its normal level, for which the carbureter was first made and adjusted.

Auxiliary jets do not help. The best remedy at present consists in exchanging the jets from time to time for smaller ones or in providing a special adjustment by which the jet openings may be regulated from the outside.

Those who have noticed an increase in fuel consumption should try a remedy which will convince them of the cause. Form a little leather ring washer about 2 millimeters thick and shove it upon the screwthreading at the lower end of the jet. Then replace the jet. The mouth of the jet is thereby raised, of course. It will be noticed that the motor will run better and will use less fuel. Anybody who is sufficiently interested in the subject can of course also dismount the carbureter and convince himself of the wear which has taken place upon the parts of the float chamber.

The radical improvement which has been devised by a prominent automobile engineer, and which is being tried to a finish at present, cannot yet be publicly described, but it may be said that it gives certain promise of rendering the functions of the carbureter entirely independent of the float mechanism as well as of weather changes. It consists in a very simple change in the feed system.—From *Allgemeine Automobil-Zeitung*, March 7.



General view of exhibits in main hall of the Boston commercial vehicle show

Business Atmosphere at Truck Show

Boston Exhibition Characterized by Practical Attendance—More Visitors Than Last Year

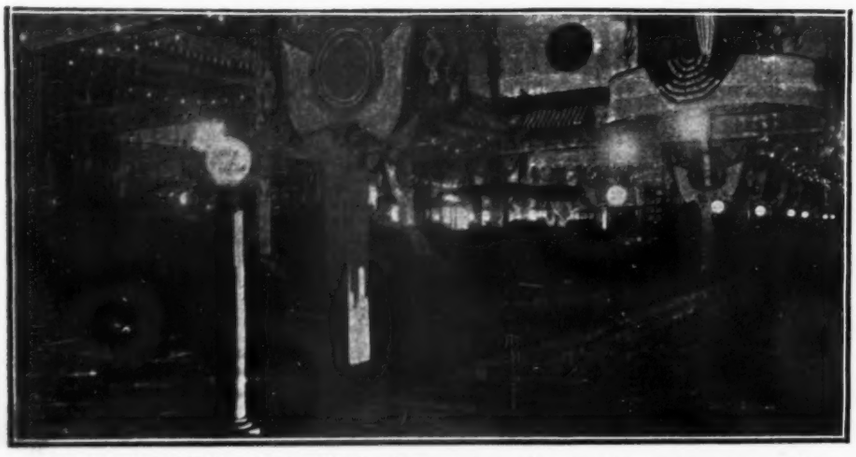
BOSTON, Mass., March 21—The 4-day motor truck show staged by the Boston Commercial Vehicle Assn. ended this evening after a fairly successful run and with the closing of the doors to-night it is debatable if Boston will have a motor truck show in 1915, notwithstanding the fact that many of the exhibitors at the present show have done a good business, and the attendance of business people from Boston and New England in general has been greater than that of a year ago.

Last year, when the National Automobile Chamber of Commerce, Inc., decided to abandon motor truck shows in New York and Chicago, the Boston dealers stood firm in their determination to have a truck show this year, and hoped to demonstrate that there is still good opportunity for such shows. The present show, the result of their determination, contained thirty-four different types of motor trucks which were displayed on the main floor of Mechanics' Hall, the building in which the passenger show was held a week ago. There was plenty of room for the thirty-four makes of trucks exhibited on the main floor, and the basement which was used a year ago was closed this season because of lack of exhibits. This space was not used during the four days.

As compared with last year, the number of exhibits was considerably smaller, there being twenty-five makes of trucks shown a year ago that were not exhibited this year. It is only fair to state that of these twenty-five some eight had discontinued business, leaving a net loss of seventeen makes of exhibits to the show. This net loss is cut down when it is remembered that eight new concerns were in place this year for the first time. Some missing names were Peerless, International Motors, General Vehicle, etc.

This week's show, officially known as the Third Annual Commercial Vehicle Show, promoted by the Boston Commercial Vehicle Assn., was staged in the same decoration setting used for the passenger show, a Venetian scene forming the decoration in the grand concert hall, and Roman decorations being used in the exhibition hall.

The exhibits were largely representative of the American truck industry, including the names of such leaders as White, Buick, Packard, Autocar, Federal, Chase, Kissel, G. M. C., Garford, Pierce-Arrow, Selden, Willis, Kelly, Standard, Reo, Walter, Velie, Republic, Stanley, Knox, Locomobile, I. H. C., Lauth-Juergens, Atterbury and others, as given in the complete list of exhibitors.



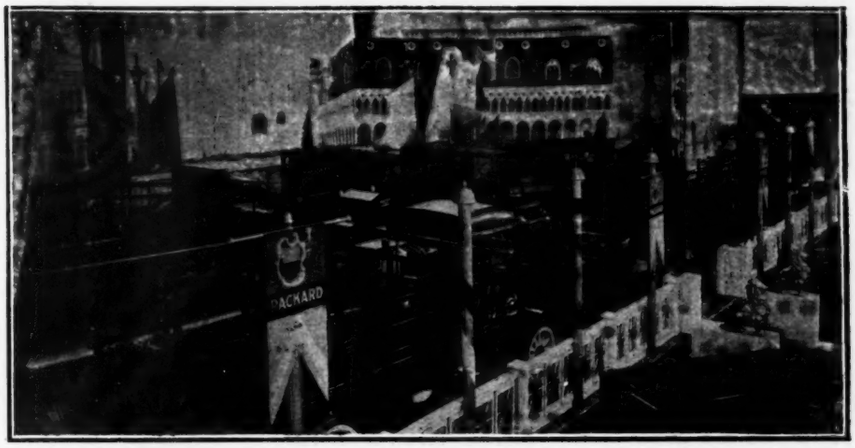
Exhibits in Exhibition Hall with its Roman decoration used in passenger car show

Much Business Done

There was good business done and many trucks sold. The attendance was good for a truck show—in excess of that of a year ago—and those who attended were representative of a good business class, not only from Boston and suburban territory, but from the entire New England section. Many of these people came to investigate and others were prepared to make purchases. There was a good representation from city and town councils throughout the territory, these delegations investigating for such departments as police, fire, hos-

pitals and water systems. There were actual sales made of vehicles of 1-ton capacity and under to water commissioners who wanted some speedy repair vehicle to carry a force of men and repair apparatus to points where breaks in the system might occur.

Industrial houses were well represented, these including the various kinds of New England factories, street railway companies, suburban trolley lines, etc.



Stage of Grand Hall with two truck exhibits, White and Packard, at the Boston truck show

Attendance Beats 1913

The attendance could not be compared with that of a passenger car show, but in the afternoons and evenings the exhibits were well patronized, and in the evenings particularly the aisles gave a fairly well-filled appearance. The fur coat of the up-to-date business man was evident on every hand, and the crowd was in strong contrast to that attending a passenger show in the evening. Very few women were in attendance, and where they were seen formed a part of the group which were intent on studying the different trucks. The figures for the four days will exceed those of a year ago.

Those exhibitors showing for the first season were tonight in favor of another show. One company, which established its New England connection in January of this year, was busy during the 4 days placing a dozen or more sub-agencies in the six states. Nearly all of the other newcomers spoke enthusiastically over the possibilities of the show. In contrast with these newcomers were the old-established firms who felt that they had little to gain from the show, and that, although they made real sales during the 4 days of the show, they were equally confident that these sales would have been made at approximately the same time if the show had not been held.

Sells Without Shows

One large exhibitor was certain of selling ten or twelve trucks, which would leave a good profit after paying for exhibit spaces and the natural upset of business routine due to the show. He had to be favorable for another show, although feeling more or less certain in his own mind that the truck business would be as well without the show and the expenditure that goes with it.

Viewed solely from the viewpoint of the visitor, it cannot be denied that a motor truck show, such as held this week, offers an easy method of investigating different makes of trucks to the buyer living outside of Boston. During the 4 days of the show there had been 110 different chassis fitted with bodies in show spaces, and in addition, thirty-seven chassis without bodies. These have represented thirty-four different makes of trucks. The buyers from Maine, New Hampshire, Vermont, Rhode Island, Connecticut and Massachusetts have had an excellent opportunity of examining all of these different makes in a relatively short period of time. It would have been impossible for these buyers to have examined them to the same extent if a whole week were expended on it by visiting the different Boston salesrooms or the salesrooms in other cities.

Good Body Display

It would be impossible to see all of the different body types which have been displayed here for 4 days in a circuit of the salesrooms because the majority of the bodies exhibited were on chassis sold to different industries in different parts of New England. These chassis were fitted with bodies designed to meet the requirements of the different buyers and were painted and lettered according to the needs of the different purchasers. This in itself constituted an interesting aspect of the show and gave the buyer an opportunity of studying bodies.

Caution Plate Increase

An interesting development revealed at the show was the growth of the caution plate idea. The Chamber of Commerce standard caution plate is being used much more generally than formerly, while many other manufacturers have

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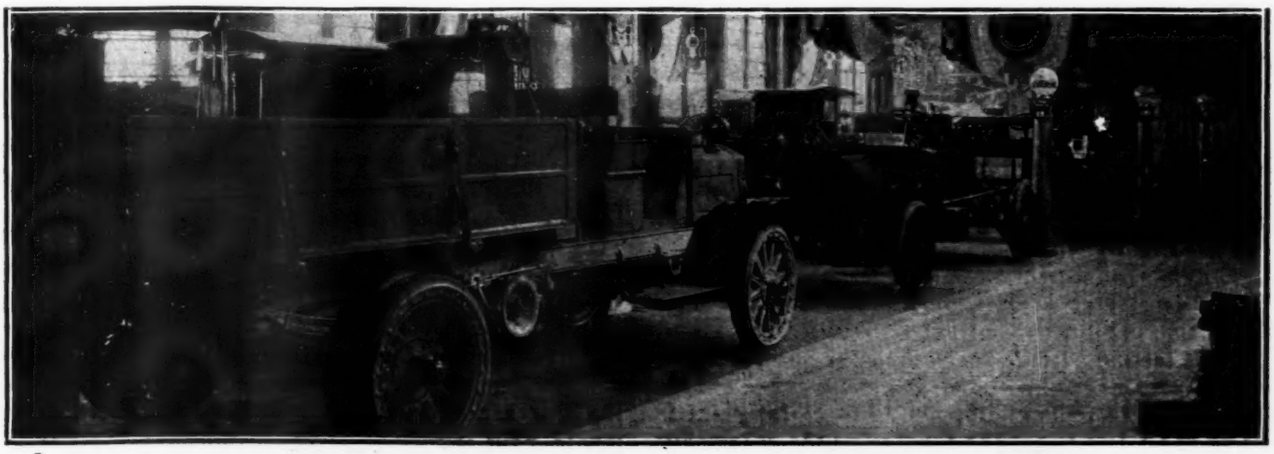

Boston truck show, with Roman decorations. Standard and Federal trucks in foreground

The Automobile

PUBLISHED WEEKLY

Vol. XXX Thursday, March 26, 1914 No. 13

THE CLASS JOURNAL COMPANY
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W. I. Ralph, Vice-President E. M. Corey, Treasurer
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Entered at New York, N. Y., as second-class matter.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

The Outdoor Seed

IN these days when the leaders of our manufacturers are seeking the country quiet, buying homes 30 or 40 miles out of the city, and when not living at these places going in personal tours over parts of the country new to them, it is surprising that these same people have been opposed to national or local tours. They have counselled their dealers not to participate in such contests, they have refused themselves to enter such, yet their very methods of life demonstrate that they are themselves in favor of the country as a rejuvenator of lost energy and as a prolific breeding ground of new ideas.

Perhaps some of our makers did not require these tours as additional selling arguments; if they did not others did. But the real value of such tours was the stimulation they gave to touring. They told of the possibility of getting speedily and safely from place to place in the automobile. New buyers are coming to the front each year; these people are new to the possibilities of motoring and have to receive the seed of inspiration.

France realized the necessity 2 years ago of once again developing such a spirit. Let us have some more tours, tours staged not so much for the purpose of testing cars as developing the outdoor spirit in our present owners. Let us get them beyond the confines of their own city, county or state; plant in them the desire to see the country as the automobile gives them power to.

New England's Truck Show

THE Boston dealers' motor truck show held last week, and the only exclusive truck show of the year, gives promise of not being continued next year, if many of the dealers who exhibited can control matters. These dealers do not want to discontinue their local show because the attendance was poor; in fact, it was better than a year ago; they do not want to discontinue it because sales were particularly poor, as they made several sales, more than enough to take care of cost of exhibit space, etc.; but they feel that the show upsets their season too much and that many of the sales they make would come whether they held a show or not.

The old well-established dealer has nothing to gain by shows and considers them more or less of a charity act for the new truck maker or dealer looking for a favorable opportunity to launch his merchandise. With these old-established dealers the truck show is looked upon as little if any benefit and he rarely wants his prospects to attend the show as he stands a certain chance of losing sales.

With the new dealer it is quite different; he is favorable to shows, and, as one expressed it, "I would like this show to continue for 3 weeks." With the diverse interests it is quite impossible to please all. They are divided against themselves. Look, then, at the other side of the question, the buyer, and see if he gets any value from such a show.

That the buyer is interested in shows was amply demonstrated by the attendance, which, while not large in passenger car figures, was good from a real selling viewpoint. The attendance was more out-of-Boston than in-Boston people, demonstrating that the Boston prospects have all the opportunity they care for to examine trucks at local agencies; but with the out-of-Boston buyer it is different and the captain of industry from Maine, Vermont, New Hampshire, outside points in Massachusetts and Connecticut apparently welcomes the show as affording him a simple and relatively easy way of examining many different makes of trucks and going from exhibit space to exhibit space, in a few minutes to make comparisons so far as construction, body equipment and perhaps prices are concerned. This same out-of-Boston buyer would require several days in Boston going to and fro among the salesrooms to acquire the same amount of truck knowledge and perhaps then would not have an opportunity of seeing such a display of different body types built expressly to meet the diverse conditions of varied industries.

The Boston truck show offers a better opportunity to New England than it does to Boston. Boston does not need a truck show but it is questionable if New England does not. It is harder to get local truck dealers in Maine, in Vermont, in New Hampshire and in the other New England states than it is to get passenger car dealers. It requires much more money to handle trucks. A few makers realizing this are endeavoring to make selling arrangements with industrial houses who have purchased one or more of their trucks.

Bridge and Tunnels To Join N. Y. and N. J.

New Jersey Has Offered To Pay Its Share But New York Holds Back, Commissioners Tell Truck Club

NEW YORK CITY, March 20.—The Motor Truck Club and the Electric Vehicle Assn. were joint hosts on Wednesday evening to the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission at the Automobile Club of America. All the organizations in the city which are interested in its traffic development were the guests of the evening, as the subject was that of the proposed bridge to be placed over the Hudson at about Fifty-ninth Street, and the tunnels being considered as a means for joining Canal Street, in New York, and Thirteenth Street, in Jersey City.

Ex-Senator Martin Saxe, of New York, opened the meeting, drawing attention to the benefits which would result from the adoption of such bridge or tunnels.

New Jersey Ready to Pay Its Share

He was followed by Senator J. A. C. Johnson, of New Jersey, who said that the passage of the necessary measure in his State was likely at this session of the Legislature. This news was decidedly in contrast to the outlook in New York State, according to ex-Senator Saxe, who said that the up-State legislators contended New York City should pay for such improvements. Mr. Saxe pointed to the fact that his community would actually pay 75 per cent of the cost, even if the State undertook to finance the project.

Engineering Problems Already Solved

Mr. Hodge, of Boller, Hodge & Baird, consulting engineers, stated that the engineering problems in connection with the bridge had been solved, though the span would have to be 2880 feet in length, owing to the necessity for keeping the navigable part of the river clear of piers, etc. The longest bridge span at the present time is only 1700 feet.

Mr. Snyder, of Jacobs & Davies, Inc., also gave an interesting illustrated talk, showing tunnels similar to the one proposed which are now in use, and stating that the engineering side of the work would be easy.

Cost of Bridge $42,000,000

The estimated cost of the bridge is $42,000,000. The estimated cost of the tunnels is $11,000,000. The entire length of the bridge from Ninth Avenue to the top of the Palisades will be 8330 feet. There will be 4920 feet between anchorages of the bridge and the center span will be 2880 feet.

The total length of the tunnels will be 9350 feet, and the angle of approach will make a 3 per cent. grade on the New Jersey side, and a 3.7 per cent. grade on the New York side.

Fourteen Cars Entered for 500-Mile Race

INDIANAPOLIS, IND., March 22.—There are fourteen cars entered to date for the 500-mile race, which is to be run May 30 at Indianapolis. Three entries not yet made, but which are promised, are three Maxwells, which Ray Harroun has designed and which Ernest Moross will campaign. The latest entry is E. C. Patterson's six-cylinder Mercedes announced in THE AUTOMOBILE last week with Ralph De Palma as driver. The entry list thus far has these cars:

NO.	CAR.	DRIVER.	ENTRANT.
1	Burman	Burman	W. A. Thompson
2	Stutz	Cooper	Stutz Motor Car Co.
3	Stutz	Anderson	Stutz Motor Car Co.
4	Gray Fox	Wilcox	E. P. Fox
5	Bullet	Keene	
6	Peugeot	Goux	Peugeot Co.
7	Peugeot	Boillot	Peugeot Co.
9	Sunbeam	Chassagne	Sunbeam Co.
10	Delage	Guyot	Delage Co.
12	Excelsior	Christiaens	Excelsior Co.
14	Peugeot	Duray	J. Meunier
15	King	Klein	King Motor Car Co.
16	Delage	Thomas	Delage Co.
17	Burman	No name	W. A. Thompson

Business Atmosphere Characterizes Boston Truck Show

(*Continued from page* 703)

followed in spirit by equipping their trucks with caution plates of their own design. There were twenty-five makes at the show equipped with caution plates and nine without, seven of the first number being of the type furnished by the Chamber of Commerce and the remaining eighteen of individual design.

Another trend that is to be strongly indorsed is that of putting the most important instructions to the driver on the dash, constantly under his eye, instead of in an instruction book which is rarely looked at until the mischief of neglect has been done. The Autocar, Lauth-Juergens, Packard and Pierce-Arrow are the trucks at the Boston show so equipped.

Left steer and center control was by far the most popular at the show, 53 per cent. of the trucks exhibited being left steer and center control, 30 per cent. right steer and right control, 9 per cent. right steer and center control, and 8 per cent. left steer and left control.

Selling Factor Low

So far as the show attendants were concerned there seemed little change in the manner of conducting the show than that used in the New York and Chicago shows of a year ago, which were considered unsuccessful. There were good forces of salesmen on the floors, and these were more active in introducing themselves to visitors in the exhibit spaces than was the occasion at the recent passenger car show. Unfortunately, these salesmen were not always as well posted on truck transportation as they were on the mechanics of the motor and chassis. At times they seemed to have an utter lack of knowledge as to the capacity of the vehicle best suited to the would-be purchaser.

Poor Show Catalogs

The catalogs distributed were not specially well suited for truck selling. The majority of them contained mechanical descriptions, but many of them did not contain enough pictures of installations. The Pieree company distributed a particularly exhaustive booklet in which the majority of its trucks sold were either actually illustrated in actual operation or listed in some manner or other.

There was little effort made in any of the exhibit spaces to fit up miniature offices where prospects could be seated in partial seclusion and shown blueprints or given an opportunity of studying figures of actual performances of trucks in varied industries. One salesman contented himself by sitting on the truck chassis and permitting an interested prospect to stand while he gave his varied arguments.

The complete list of trucks exhibited follows:

Atterbury	Jeffery	Merz	Selden
Autocar	Kelly	Overland	Stewart
Buffalo	KisselKar	Packard	Standard
Buick	Knox	Parcel Post	Stanley
Chase	Lauth-Juergens	Palmer-Moore	Universal
Federal	Little Giant	Pierce-Arrow	Velie
Garford	Locomobile	Republic	Walter
G. M. C.	Mais	Reo	White
I. H. C.			Willys

Lycoming Co. Denies Use of Defective Motors

Also Denies That It Has Managed Herreshoff Company Through a Representative

DETROIT, MICH., March 24—Denial of the charges made by the Creditors' Committee of the Herreshoff Motor Co., consisting of H. W. Paton, Detroit Body Co.; J. H. French, Michigan Stamping Co., and J. L. Dryden, Long Mfg. Co., as published in THE AUTOMOBILE for March 5, was made today by the Lycoming Foundry & Machine Co. According to this statement, as made by the committee, the Lycoming concern has, through a representative, managed the Herreshoff company since last fall. The Lycoming company states that this is untrue and that C. F. Herreshoff has retained his title as general manager of the company.

The Lycoming company made the following statement:

"Some months ago the Herreshoff Motor Company was being pressed by its creditors, and it was thought that if the Lycoming Foundry Company, who was the principal creditor, would hold off and not press its claim, that the other creditors could be induced to do likewise. It was also recognized, even by the Herreshoff officials, that someone representing the creditors would have to be at the plant as a check upon expenditures, because while several notes of the Herreshoff company had shortly before that gone under protest, two leading officials of that company had paid to themselves a sum in excess of $6,000 out of the treasury of the company.

"A representative of the Lycoming company and of two other creditors was subsequently put on the board of directors. The Lycoming representative acted in good faith throughout and did the best he could to preserve the estate, reduce the debts and benefit the creditors generally.

"The Creditors' letter referred to above was not written by the so-called Creditors' Committee, who signed it, but was written and mailed by an attorney who enclosed blank proof of claim and power of attorney to his firm, and whose information was obtained from the attorney for the Herreshoff company. The Lycoming company was given no opportunity to present its side of this controversy, but the letter was written and sent forth entirely on the statement of one party to the case.

"It is not true that there was an understanding that interest was not to be paid upon notes. Very few creditors received notes, few asking for them. Some creditors, including the Lycoming Company, already had notes upon which interest was paid as heretofore. The concern did not come under the management of a representative of the Lycoming Company, but Mr. Herreshoff continued as general manager. The latter company did not receive 1 cent upon the account that was due it at the time its representative went to Detroit. The only money it received was for new motors and motor parts furnished subsequent to that time, and which were sold upon a cash basis. All other creditors selling goods to the Herreshoff company after the creditors took charge were also paid in cash. It is false that an attempt was made, one way or another, by its representative to give it preference.

"Regarding the allegation that the motors furnished by this company were defective, we have only to say that we welcome an opportunity to contest this question before a proper tribunal and to add that the history of the Herreshoff company shows that it has in the past made contracts with other reputable motor manufacturers and in each instance has refused to accept and pay for the motors on the ground that they were defective."

The first meeting of the creditors for the election of a trustee will be held at the office of Lee Hoslyn, Referee in Bankruptcy, on March 26.

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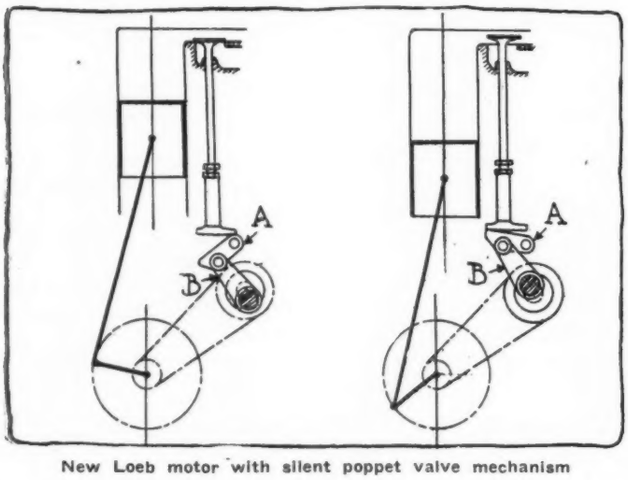
New Motor Has Poppet Valves and No Cams

LONDON, ENGLAND, March 15—An interesting poppet valve design has been brought out by Messrs. Loeb & Co., maker of the Loeb car, Charlottenburg, in which an effort has been made to get away from noisy camshafts and at the same time retain the poppet type of valve, with its many advantages. This mechanism, while it employs a cam in the strict sense, differs widely from the ordinary construction as will be seen from the accompanying illustration. At the left, the valve is shown in its closed position while it is shown open at the right. The valve tappet is actuated by the cam lever A which takes its motion from the connecting rod B which is attached to a crank on the half-time shaft. It will be noted that the valve tappet is started in motion without any blow, something that can not be done with the ordinary cam mechanism. The speed of valve opening, the period of dwell and the speed of closing can all be regulated by the shape of the tappet shoe and the cam lever A.



New Loeb motor with silent poppet valve mechanism

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Detroit Service Men Organize

DETROIT, MICH., March 23—With the original idea of improving the service departments of the automobile industry and by the interchange of ideas to give each member the benefit of the experience of the others, service managers of the various automobile plants of the city have formed an organization, which will number from sixteen to twenty members. The officers elected are: D. H. Haselton, Regal Motor Car Co., president; A. B. Hanson, Chalmers Motor Co., vice-president; G. O. Baldwin, Studebaker Corp., secretary; Virgil Oldberg, Hudson Motor Car Co., treasurer.

That the movement is undoubtedly a good one is evidenced from the expressions of approval of the idea by prominent manufacturers. Mr. Haselton states that he believes it to be far-reaching in its scope. A general understanding of methods of handling adjustments, claims, and policy with respect to service departments is aimed for, and a standardization of these matters and co-operation will benefit both manufacturer and purchaser.

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$1,500,000 Tire Concern Incorporated

NORWALK, CONN., March 24—The Norwalk Tire & Rubber Co., has been incorporated in this city with a capital of $1,500,000. The company will manufacture, purchase and sell rubber and rubber goods, making tires a feature. The incorporators are Earle Banks, John Pierce and Sayer Youngs. It is reported that W. B. Miller, formerly with the Diamond Tire Co., is the organizer of the company, though his name does not appear in the incorporation papers.

The business will be launched with $200,000 paid in at the start. The stock is to be divided into 5,000 shares of preferred and 10,000 shares of common stock. The preferred stock is to pay 7 per cent. before the common can participate in dividends.

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Ready to Make Cyclecar Motors

DETROIT, MICH., March 24—The Hermann Engineering Co. is now in a position to manufacture small four-cylinder motors suitable for light cars or cyclecars in large quantities. The engine is block cast and 2½ by 4 inch size. Being water cooled, it is stated that the weight can be reduced to 155 pounds. The normal weight is 170 pounds, the difference being due to the quantity of iron or aluminum optionally used. The crankshaft is a single piece drop forging. The cylinder head is removable as is also the lower half of the crankcase.

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May Hold California Grand Prix

SAN FRANCISCO, CAL., March 20.—There is a project on foot to hold an automobile race to be known as the California Grand Prix on the new $100,000 speedway at Pomona, Cal., September 9. According to the plans of the promoters, a purse of $25,000 is to be offered to the winners.

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To Have National Touring Week

NEW YORK CITY, March 25—Alfred Reeves, general manager of the National Automobile Chamber of Commerce, Inc., today announced plans for establishing a national touring week in the end of June each year for the automobile industry. His thought is to have this as a week of local touring throughout the entire country. Dealers' associations will be encouraged to have tours among their members during that week, these tours to be for some simplified form of stock car which the dealer can advertise as such. Mr. Reeves plans further suggest that the National Chamber of Commerce offer bronze medals to all of the dealers' associations as winning prizes.

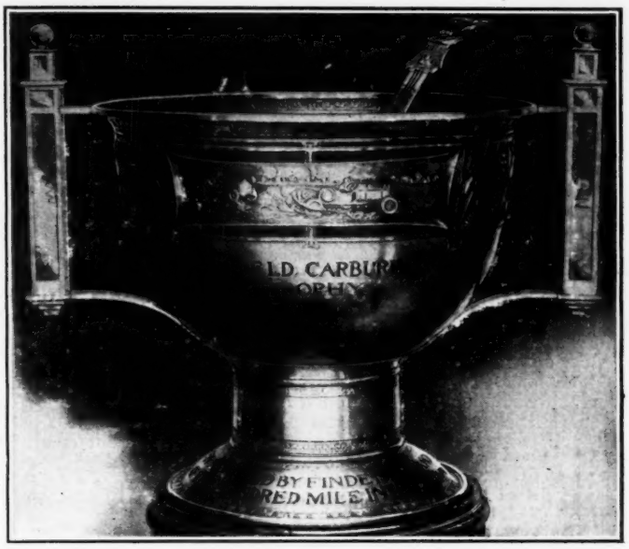
The automobile clubs throughout the country are to be invited to put on tours for their members during the same

week, these tours to be under different rules than those of the dealers.

Mr. Reeves' thought back of this touring movement is that it is better for conditions in general to have people circulating locally and nationally than to become stay-at-homes. It is just as essential to circulate people as to circulate money.

Rayfield Offers Indianapolis Trophy

CHICAGO, ILL., March 24—Findeisen & Kropf, manufacturers of the Rayfield carbureter, have offered a princely prize to the driver winning two races with a Rayfield-equipped car. The first opportunity to secure a leg on the trophy will be at the Indianapolis race. It is a sterling silver punch bowl lined with gold and valued at $2,000. In addition this company is offering cash prizes of $1,000, $300 and $200 for first, second and third place. The punch bowl is illustrated herewith.



Sterling silver punch bowl offered to the driver winning two races with a Rayfield-equipped car by Findeisen & Kropf

Trenton to Pay Tribute to Pullen

TRENTON, N. J., March 24—The city is planning to pay homage to Edwin Pullen and the Mercer Automobile Company on April 4 in recognition of the winning of the Grand Prize race at Santa Monica, Cal., February 28, by Pullen in the Trenton-made Mercer car.

The nearby towns and cities will join with Trenton in honoring the Mercer for being the first American car to win the Grand Prize cup. The plans call for a parade, in which it is expected that several hundred automobiles will be in line, the pagaent twice passing the reviewing stand in front of the City Hall.

Pullen and his mechanician, Andrew Vollman, Jr., are to ride at the head of the procession in the car with which Pullen won the famous race, followed by a string of Mercer cars.

After the parade it is planned to have an official of the Automobile Club of America formally present to the Mercer Automobile Company the $5,000 Grand Prize gold trophy. The Mayor will present to Pullen and Vollman solid gold watches and fobs of Trenton make. On the back of each watch will be engraved a replica of the Grand Prize cup.

Following the city's celebration in the afternoon the Mercer Automobile Company has arranged a smoker to be given in the evening in Masonic Temple to all of the Mercer factory employees.

Recent Developments in State Automobile Legislation

Would Amend N. J. Motor Car Law

TRENTON, N. J., March 24—Some changes in New Jersey's motor vehicle law are contained in a supplement to the present law submitted to the legislature today by the commission appointed last year to confer with commissions of seven other states in a plan to make motor laws uniform. The proposed changes are as follows:

Government-owned vehicles shall be subject to registration, but no fee shall be charged.

Provides for free registration on old certificates for vehicles replacing ones destroyed or transferred.

Non-residents, convicted of motor law violations, must register and take out license just as residents.

Prohibits unnecessary noises.

Restricts use of searchlights.

Makes use of muffler mandatory.

Garage keepers shall keep record of cars entering and leaving their places.

Restricts use of metal spurs or lugs.

Motor vehicles shall not pass car from which passengers are alighting.

Courts shall keep record of motor law violations.

Violators of act shall be subjected to fine not exceeding $100, in default of which they shall go to jail for not more than ten days.

Chauffeurs Want Griffin Bill

NEW YORK CITY, March 24.—At an executive meeting held recently by the Professional Chauffeurs Club of America, and at which other organizations were in attendance, it was decided to urge the adoption and passage of the Griffin bill, as it stands, and further, to call a mass meeting for Wednesday night, March 25, to be held at the club room, 240 West Fifty-fifth Street, at 8 P. M., inviting all interested to attend, and to invite Hon. Senator Anthony J. Griffn, sponsor of the bill, as also F. H. Berg, Jr., the father of the proposed bill.

The president, Mr. Walter, explained that the Griffin bill would, if passed, repeal the Callan law entirely, and is a complete law in itself, and that it called for the appointment of a New York state traffic commission by the Governor, and a city traffic commissioner, to be appointed by Mayor Mitchel. It calls for the examination of every motor vehicle during each year and the registraton of all persons driving a motor vehicle, setting them apart into three classes: Licensed drivers, owners; licensed drivers, non-owner who drive without compensation, and licensed chauffeurs who drive for compensation. This, if carried into effect, would soon show who did the injuries and killing in the future.

The state commission of local traffic commissioners would have at their discretion six reasons by law for the revocation of licenses.

The chauffeurs are to have an 8-hour working period in a 12-hour duty day.

Two Street Safety Bills Introduced

NEW YORK CITY, March 23.—The Merchants' Assn. has indorsed two street safety bills introduced in the state Senate at the request of the corporation counsel by Senator Simpson. One bill amends the city charter by increasing the limit of policemen in the traffic squad in this city from 550 to 1000. The other measure provides that disobedience of an order issued by the police in the enforcement of the rules governing vehicular traffic in public places shall be a misdemeanor, punishable by imprisonment for not less than 2 nor more than 30 days, or by a fine of not less than $5 nor more than $50, or both.

Recommends Convict Labor

NEW YORK CITY, March 23.—In the annual report of the state commission of prisons, recently submitted to the Legislature, larger appropriations for the employment of convicts on the highways in this State are strongly recommended.

Although the present law restricts the use of convicts on the roads to an area of 30 miles of the prison, in which the men are confined, it is stated that over 400 convicts were employed in the road work during the past year. It is stated that 122 prisoners from Auburn were employed on work in Cayuga County at various times during the year. The results of the work thus far done are reported as gratifying.

Governor Glynn offered to-day to the Legislature in a special message what he believes is the solution of the highway problem in the State, the employment of convicts in the State prisons in the manufacture of brick with which to build State highways. The message strongly urges the construction of brick rather than macadam roads. The total saving, he states, with convict-made bricks in the 7300 miles of road yet to be constructed would amount to $146,000,000 in the 20 years after their completion. A new system of highway patrol and inspection and the adoption of a policy which would relieve small communities from maintaining expensive highways and bridges is urged by the Governor.

Mutual Plan for Insuring Cars

ALBANY, N. Y., March 19.—A bill has been introduced in the Legislature by Senator Foley, inserting in the insurance law a new article permitting thirteen or more owners of automobiles, not used in trade or manufacture, or operated for hire, to incorporate for the purpose of insuring, on the mutual plan, against damage, accident, or legal liability. Detailed provisions for the organization of such corporations are contained in the bill. It has been advanced to the third reading and referred.

Electric Storage Battery Earns $1,208,755

PHILADELPHIA, PA., March 22.—The annual report of the Electric Storage Battery Co. for the year ending December 31, 1913, shows that the earnings on the outstanding shares of $17,845,000 common and $155,000 preferred stock amounted to $1,208,755, compared to $1,125,279 in 1912. The surplus warrants the payment of dividends at the rate of 7.46 per cent., as compared with 6.92 per cent. for 1912, a gain of 0.54 per cent. for the past year.

Gross sales, less cost of manufacturing, etc., were $1,558,123, as compared with $1,536,190 in 1912, an increase of $21,933. After paying dividends there remains $558,791 surplus, making the accumulated surplus on December 31, 1913, $3,312,522. This shows a large increase over the 1912 figures, which, however, included an allowance of $808,400 for depreciation of United States Motors Co. securities, $48,339 loss in value, undepreciated, of old buildings replaced by new factory, and $128,741 deducted for sundry adjustments and items not incident to the year. This 1912 loss was partially offset by $47,610, representing par value of bonus stock of Chloride Electrical Storage Co., Ltd.

The company is in a prosperous condition. During 1913 $20,000 of preferred stock was converted into common, reducing the outstanding preferred to $155,000 and increasing the common to $17,845,000.

Cash in hand is $417,835, compared with $323,570 in 1912, a gain of $94,265. Stocks and bonds of other companies owned amount to $1,378,721, as against $1,333,388, an increase of $45,333.

Besides the accumulated surplus, the company has a reserve fund of $672,710 for plant depreciation, etc.

Directors of the company have declared a dividend of 1 per cent., payable April 1, on both common and preferred stock.

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HARTFORD, CONN., March 23.—The Hartford Auto Parts Co. has contracted to supply the American Cyclecar Co., Bridgeport, Conn., with $200,000 worth of parts for its cyclecar. Transmissions will constitute the leading part of the order.

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Government Wants Postal Truck Supplies

WASHINGTON, D. C., March 21.—On April 22 the post office department, through the purchasing agent, will open bids for furnishing a quantity of supplies for the use of motor cars in the postal service during the fiscal year beginning July 1, 1914. The supplies that will be required include transmission and cup grease, horn bulbs, cylinder and heavy oil, blow-

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Automobile Securities Quotations

Increased activity and larger sales were the rule in the automobile securities market during the past week, featured by several large increases in value. Goodyear common rose 25 points on Tuesday, due to fluctuation of the market and a steady demand. Vacuum Oil made a still larger gain, 26 points, rising from 225 to 250 on Saturday and then to 251 on Tuesday. There is to be a meeting of the directors of the company in a week and there are rumors of a dividend.

Kelly-Springfield Tire was in good demand, the preferred showing a gain of 7 points over last Tuesdav's figures, while the common rose 1 point. There are a number of back dividends to be paid on the preferred which gives added strength to the demand.

Other changes of note were the Miller Rubber gain of 7 points, Willys-Overland's increase of 3 points on the common and 5 on the preferred and Stewart-Warner's gain of 2½ on the common and 1 point on the preferred. Swinehart dropped 9½ points. These changes were simply due to fluctuation of the market.

Security	Wednesday Bid	Wednesday Asked	Thursday Bid	Thursday Asked	Friday Bid	Friday Asked	Saturday Bid	Saturday Asked	Monday Bid	Monday Asked	Tuesday Bid	Tuesday Asked	Week's Change	1913 Bid	1913 Asked
Ajax-Grieb Rubber Co., com	200	...	200	...	200	...	200	...	200	...	200	...	..	150	-160
Ajax-Grieb Rubber Co., pfd	99	-102	99	-102	99	-102	99	-102	99	-102	98	-102	— 1	95	-100
Aluminum Castings, pfd	98	-100	98	-100	98	-100	98	-100	98	-100	98	-100	..	95	- 99
Chalmers Motor Co., com	80	- 84	80	- 84	80	- 84	80	- 83	80	- 83	..	- 83	..	104	-107
Chalmers Motor Co., pfd	92	- 94	92	- 94	92	- 94	92	- 94	92	- 94	..	- 94	..	120	-135
Firestone Tire & Rubber Co., com	284	-290	284	-290	284	-290	284	-290	284	-290	285	-292	+ 1	265	-275
Firestone Tire & Rubber Co., pfd	108½	-110	108½	-110	108½	-110	108½	-110	108½	-110	108	-109	— ½	103	-106
Garford Co., pfd	80	- 90	*80	- 90	80	- 90	80	- 90	80	- 90	80	- 90	..	95	-100
Generals Motors Co., com	73¾	- 75¾	74½	- 86½	74½	- 76½	75	- 76	75	- 76	75⅛	- 75¼	+ ⅛	28	- 33
General Motors Co., pfd	92	- 93	92	- 93	92	- 93	92	- 93	92	- 93	92½	- 93	+ ½	76½	- 77½
B. F. Goodrich Co., com	22½	- 23½	22½	- 23½	22½	- 23½	23	- 23½	23	- 23½	23	- 23¾	+ ½	31½	- 32½
B. F. Goodrich Co., pfd	86	- 90	86	- 90	86	- 90	86	- 88	86	- 88	86	- 88¼	..	94	- 96½
Goodyear Tire & Rubber Co., com	180	-185	180	-185	175	-180	150	-160	150	-160	175	-180	+25	360	-370
Goodyear Tire & Rubber Co., pfd	93	- 95	93	- 95	93	- 95	93½	- 95	94	- 95	94	- 95	+ 1	102½	-103½
Gray & Davis Co., pfd	90	- 97	90	- 97	90	- 97	90	- 97	90	- 97	90	- 97	..	..	..
*Hayes Manufacturing Co.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
International Motor Co., com	..	- 5	..	- 5	..	- 5	..	- 5	..	- 5	..	- 5	..	..	- 90
International Motor Co., pfd	..	- 15	..	- 15	..	- 15	..	- 15	..	- 15	..	- 15	..	5	- 10
Kelly-Springfield Tire Co., com	59	- 60	57	- 58	57	- 58	58½	- 59	58½	- 59	58	- 60	+ 1	35	- 45
Kelly-Springfield Tire Co., pfd	138	-141	136	-140	136	-140	140	-145	140	-145	143	-145	+ 7	15	- 20
Kelly-Springfield Motor Truck Co., com	*	- *	*	- *	*	- *	*	- *	*	- *	..	- ..	..	..	- 79
Kelly-Springfield Motor Truck Co., pfd	*	- *	*	- *	*	- *	*	- *	*	- *	..	- ..	..	..	..
Lozier Motor Co., com	13	- 16	13	- 16	13	- 16	13	- 16	13	- 16	13½	- 16½	+ ½	..	..
Lozier Motor Co., pfd	..	- 65	..	- 65	..	- 65	..	- 65	..	- 65	..	- 65	..	..	..
Maxwell Motor Co., com	6½	- 7	6½	- 7	6½	- 7	8¼	- 8¾	8¼	- 8¾	8	- 8¾	+ 1½	..	..
Maxwell Motor Co., 1st pfd	34	- 35	34	- 35	34	- 35	33	- 34	33	- 34	32½	- 34	— 1½	..	..
Maxwell Motor Co., 2nd pfd	12	- 13	12	- 13	12	- 13	12½	- 13	12½	- 13	12	- 12½	..	..	..
Miller Rubber Co.	128	-133	128	-133	128	-133	128	-133	128	-133	135	-141	+ 7	180	-195
New Departure Mfg. Co., com	118	-123	118	-123	118	-123	118	-123	118	-123	120	-125	+ 2	..	..
New Departure Mfg. Co., pfd	105	-107	105	-107	105	-107	105	-107	105	-107	106	-108	+ 1	..	..
Packard Motor Co., com	101	-116	101	-116	101	-116	101	-116	101	-116	101	-116	..	..	..
Packard Motor Co., pfd	95	- 98	95	- 98	95	- 98	95	- 98	95	- 98	95	- 98	..	..	..
*Palmer & Singer, pfd	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Peerless Motor Co., com	20	- 30	20	- 30	20	- 30	20	- 30	20	- 30	20	- 30	..	..	..
Peerless Motor Co., pfd	..	- 80	..	- 80	..	- 80	..	- 80	..	- 80	..	- 80	..	..	..
Pope Mfg. Co., com	1	- 3	1	- 3	1	- 3	1	- 3	1	- 3	1	- 3	..	..	..
Pope Mfg. Co., pfd	11	- 15	11	- 15	11	- 15	13	- 17	13	- 17	12	- 16	+ 1	17	- 22
Portage Rubber Co., com	..	- 35	..	- 35	..	- 35	..	- 35	..	- 35	..	- 30	..	62	- 68
Portage Rubber Co., pfd	..	- 90	..	- 90	..	- 90	..	- 90	..	- 90	..	- 85	..	..	..
†Reo Motor Truck Co	8	- 8½	8	- 8½	8	- 8½	8	- 8½	18¾	- 19¼‡	7	- 8¼	+ 1	..	..
†Reo Motor Car Co	18½	- 19¼	18½	- 19¼	18½	- 19¼	18¼	- 20	18¼	- 20	18¾	- 19¼	+ ¼	11½	- 11½
Rubber Goods Mfg. Co., pfd	105	-110	105	-110	105	-110	106	-115	106	-115	105	-110	..	20½	- 21½
Russell Motor Co., com	..	..	..	..	..	..	..	..	..	..	..	..	..	104	-106
Russell Motor Co., pfd	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Splitdorf Electric Co., pfd	40	- 50	40	- 50	40	- 50	40	- 50	40	- 50	40	- 50	..	..	..
Stewart-Warner Speedometer Co., com	56	- 57	56	- 57	56	- 57	56½	- 57½	56½	- 57½	58½	- 60½	+ 2½	..	..
Stewart-Warner Speedometer Co., pfd	100	-101	100	-101	100	-101	100	-101	100	-101	99	-102	+ 1	..	..
Studebaker Co., com	30	- 30½	29	- 30	29	- 30	28	- 29	28	- 29	28¾	- 29¼	+ ¼	28½	- 29
Studebaker Co., pfd	83	- 85	82½	- 85	82½	- 85	83	- 85	83	- 85	83	- 85	+ ½	88	- 93
Swinehart Tire & Rubber Co	69½	- 70½	69½	- 70½	69½	- 70½	69½	- 70½	60	- 67	60	- 67	— 9½	95	-102
U. S. Rubber Co., com	61½	- 62	62	- 62½	62	- 62½	62	- 62½	61	- 61½	62	- 66½	..	61½	- 62
U. S. Rubber Co., pfd. 1st	102¾	-103¾	102¾	-103¾	102¾	-103¾	102½	-103	102½	-103	104	-104¼	+ 1¼	104½	-105½
Vacuum Oil Co.	225	-227	225	-227	225	-227	250	-253	250	-253	251	-254	+26	..	..
White Co., pfd	107	-110	107	-110	107	-110	107	-110	107	-110	107	-110	..	103	-108
Willys-Overland Co., com	66	- 68	66	- 68	66	- 68	64	- 67	64	- 67	63	- 66	+ 3	56	- 63
Willys-Overland Co., pfd	94	- 98	94	- 98	94	- 98	91	- 96	91	- 96	89	- 94	+ 5	90	- 98

*No market.
†The par value of these stocks is $10; all others $100. ‡Ex. Div.

out and tube patches, pressure gauges, cushion and pneumatic tires, inner tubes, tire tape, valve parts and tools, vulcanizing rubber, etc.

It is stated by the department that "it will be impossible to furnish estimates on the quantity of supplies required, as they will be called for from time to time as the necessity may arise to equip and repair the 21 three-wheeled Wagenhals and 20 White motor cars owned and operated by the department at the following post offices: Atlanta, Ga., 2 Whites; Baltimore, 3 Whites; Brooklyn, 3 Whites, Buffalo, 2 Whites; Columbia, S. C., 1 Wagenhals; Columbus, O., 2 Wagenhals; Detroit, 2 Wagenhals; Louisville, 2 Whites; Memphis, 3 Wagenhals; Minneapolis, 4 Whites; Nashville, 3 Wagenhals; Norfolk, Va., 2 Wagenhals; Philadelphia, 6 Whites, Richmond, Va., 2 Wagenhals."

All the supplies must be delivered at and within the doors of the post offices mentioned above and other offices which may be furnished with government-owned motor cars during the ensuing fiscal year.

Prospective bidders desiring proposal blanks and detailed information about the above-mentioned supplies can obtain them upon application to the purchasing agent, post office department, this city.

New Iowa Cyclecar to Sell for $400

DAVENPORT, IA., March 19.—A new cyclecar will be manufactured in Walcott, according to the plans of R. H. Blank and G. Schreiber, who invaded Davenport to-day with the first model of the new machine. It will be placed on the market at a price of from $375 to $400, and will be driven by a 12-horsepower De Luxe engine. The transmission is friction. The wheelbase is 100 inches and the tread is 36 inches. The car weighs about 400 pounds. The drive is belt.

$900 Car To Be Made in St. Louis

ST. LOUIS, MO., March 20—St. Louis soon will have another automobile factory. George A. Root, formerly connected with the Wahl Automobile Co., Detroit, and the Studebaker company, and Edwin Beebe, a local attorney, have organized the Crescent Automobile Co., with a capital of $50,000. The company, which thus far has not announced its plans of operation, has not selected a site for its factory, but will do so in the next few days. The company plans to build a car that will sell for about $900.

Medium-Priced Knight Motors

CLEVELAND, OHIO, March 23.—That the Knight sleeve valve motor is going to take a larger part in low-priced American cars was evidenced here by the organization of the Knight Engine Co., for a nominal capital, to build Knight sleeve valve engines for cars that will sell at approximately $1,500 or under. The present incorporation is but a preliminary one, and it is expected that in the course of a few weeks definite plans for a large organization will be perfected. At present Charles Y. Knight, L. B. Kilbourne, of Knight & Kilbourne, and F. E. Lonas, legal representative of the Knight interests, in connection with certain Cleveland capital, are fathering the venture.

Monarch to Make Six for $1,250

DETROIT, MICH., March 20.—Believing that there is a demand for a low-priced six, the Monarch Motor Car Co. will add such a type to its present output of fours, the new car, besides being the lightest, will be the cheapest six on the market, listing at $1,250 and weighing 2,400 pounds complete. The new car will retain the same general lines as the four-cylinder type, which was brought out last year, the hood being lengthened somewhat and sloping to the front of the radiator, being placed underneath and ahead of the motor. The power plant will be a 3½ x 5 unit type, and electric starting and lighting will be fitted. The wheelbase is 118 inches and the standard body a five-passenger. Deliveries will commence in April.

To Make Maryland Electric Truck

BALTIMORE, MD., March 22.—The Maryland Electric Vehicle and Manufacturing Co. has been incorporated to manufacture in this city the Maryland electric commercial car. The company has opened its factory and will make a feature of 1,000-pound vehicles to sell at $1,250. It will also make cars up to 10,000 pounds. Several of the 1,000-pound wagons are already on the market. The company is offering all mechanical repair parts free for 1 year and is guaranteeing its battery equipment to give 15 months' service, the company is making its own battery and generating its own current, having installed a big generator in its plant, which is operated by a gasoline engine. General storage battery work—repairing and building—is a specalty of the company. William Knoblock is manager.

Headlight Support Co. Sues Esco

DETROIT, MICH., March 20.—A suit for infringement of patent has just been brought by the Headlight Support Co., of Detroit, in the United States District Court of Detroit against the Esco Manufacturing Co., of the same city, on patent number 1,025,105 granted to F. E. Youngs on an application filed July 8, 1908. The claims of this patent are very broad and cover every possible type of device which employs a lock for controlling the flow of fuel oil from the fuel tank to the engine.

This patent has been infringed unwittingly by many users of automobiles who have permitted locking devices of this type to be installed on their cars by parties not licensed by the Headlight Support Co., of Detroit. This latter concern will protect its patent in the courts and plans a vigorous crusade against deliberate infringers, according to the Headlight company. The device is known as the Gasolock.

Oppose Walpole Reorganization Plan

BOSTON, MASS., March 19.—The proposed reorganization plan recently sent to the stockholders of the Walpole Tire & Rubber Co. has been accepted by about one-third of all the stock outstanding. The protective committee and the stockholders' committee have both evinced opposition to the proposed plan. It is understood that these two dissenting committees, which control an important proportion of the stock, have prepared an alternative plan which differs radically from the Metzler proposition. Mr. Metzler's proposition was to assess the preferred stockholders $25 per share and the common stockholders $12.50 per share. This would provide $640,750 of new money, to be applied to the reduction of liabilities. Members of the two dissenting committees declare they are opposed to the Metzler plan, on the ground that it is not practicable.

Market Reports of the Week

There were few changes last week in the market reports. Tin rose $.60 per 100 pounds, following a sharp rise in London. There was a better demand here, for both nearby and future positions. Electrolytic copper remained constant at $.143 throughout the week, but on Tuesday more interest was shown, the demand being stimulated by the further sharp rise at London. Both electrolytic and lake coppers showed a gain of $.001 for the week. Lead was dull and easier, remaining at $4 throughout the week. The leading event in the crude rubber trade was the auction of plantations, which was held in London. Competition was good and prices were generally higher than those secured at the last previous sale. Fine Up-River Para remained constant at $.75. Raw cottonseed oil increased 18 cents per barrel.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.05¾	.05¾	.05⅜	.05¾	.05¾	.05¾	.....
Beams & Channels, 100 lbs.	1.36	1.36	1.36	1.36	1.36	1.36	.....
Bessemer Steel, ton	21.00	21.00	21.00	21.00	21.00	21.00	.....
Copper, Elec., lb.	.14 3/10	.14 3/10	.14 3/10	.14 3/10	.14 7/20	.14⅜	+ .00 1/10
Copper, Lake, lb.	.14½	.14½	.14½	.14½	.14½	.14⅜	+ .00 1/10
Cottonseed Oil, bbl.	7.35	7.39	7.49	7.52	7.56	7.53	+ .18
Cyanide Potash, lb.	.17	.17	.17	.17	.17	.17	.....
Fish Oil, Menhaden, Brown	.40	.40	.40	.40	.40	.40	.....
Gasoline, Auto, bbl.	.16	.16	.16	.16	.16	.16	.....
Lard Oil, prime	.93	.93	.93	.93	.93	.93	.....
Lead, 100 lbs.	4.00	4.00	4.00	4.00	4.00	4.00	.....
Linseed Oil	.54	.54	.54	.54	.54	.54	.....
Open-Hearth Steel, ton	21.00	21.00	21.00	21.00	21.00	21.00	.....
Petroleum, bbl., Kans., crude	1.05	1.05	1.05	1.05	1.05	1.05	.....
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.50	.....
Rapeseed Oil, refined	.59	.59	.59	.59	.59	.59	.....
Rubber, Fine Up-River, Para	.75	.75	.75	.75	.75	.75	.....
Silk, raw Ital.	....	5.15	....	....	5.15	5.15	.....
Silk, raw Japan	....	4.30	....	....	4.28	4.28	— .02
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	38.10	38.00	37.75	37.75	38.63	38.70	+ .60
Tire Scrap	.04½	.04½	.04½	.04½	.04½	.04½	.....

Saturated Motors for Electric Trucks

NEW YORK CITY, March 24—The monthly meeting of the Electric Vehicle Association of America was held at the Engineering building tonight and was well attended. A paper entitled, "The Performance Characteristics of Electric Motors and Their Influence on the Operation of Electric Trucks," was presented by T. H. Schoepf, of the Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa. In addition a report of the activities of the association during the past month was read by the secretary.

Mr. Schoepf's paper dealt with two classes of motors, as applied to electric trucks, the magnetically saturated and the magnetically unsaturated, and showed that the former type was particularly adapted to work in level districts but that the unsaturated type was better for hills. The saturated motor is lighter, its speed decreases less with a given ampere overload, but its torque under this load is less than that obtained with the unsaturated motor.

It was brought out in this paper and also in the discussion following that the unsaturated motor was generally preferable because when carrying a given overload it took less current from the battery and the fact that its speed under these conditions was lower and its weight greater was not enough, as a rule, to outweigh the advantage of reduced current consumption.

Use of Two Motors Not Desirable

It was generally agreed that the use of the two types of motors, one for hilly work and the other for level country, in the same truck models was not desirable, first, because it was undesirable to carry two types of motors in stock, this lack of standardization increasing the manufacturing cost. Secondly, because it was impossible to make the two motors fit into the same space in the chassis. Thirdly, sometimes a truck is used for a period of time in one section of the country and then sold and used in some other section, where the character of the road is entirely different. Therefore a truck designed for level country and equipped with a high speed saturated motor would not give the best satisfaction if transferred to a hilly section, where an unsaturated motor should be used.

It was announced by the secretary in his report that a section had been established in Washington, D. C., with 25 active members. The officers of this branch are: E. S. Marlow, chairman; R. B. Emerson, vice-chairman; C. M. Marsh, secretary and treasurer, with offices at the Potomac Power Co., 231 14th street, N. W., Washington, D. C.

Col. Pardee Retires—Hadley Continues Havers

NEW YORK CITY, March 21.—Col. K. C. Pardee, for many years prominently identified with the automobile trade in this city, has announced his retirement on account of failing health. For the past year he has been handling the Havers cars in the Metropolitan territory. The Havers Sales Agency and Service Department will be conducted by W. K. Hadley Co., 1860 Broadway. Mr. Hadley is the general sales manager of the Havers Motor Car Co. His headquarters will be in New York City.

Chalmers Now Running N. Y. Agency

NEW YORK CITY, March 20—The Chalmers Motor Co., Detroit, Mich, has bought the Carl H. Page Co., which had the Chalmers agency in this city for nearly 7 years. The Detroit company will take over the operation of the agency immediately. The name of the company in the future will be the Chalmers Motor Co. of New York. George Stowe will continue as manager. Mr. Page will retire temporarily from the business world and will take a short vacation.

Tiffany Becomes Flanders Electric Again

DETROIT, MICH., March 25—*Special Telegram*—The name of the Tiffany Electric Co., which some time ago took over the assets of the Flanders Mfg. Co., Pontiac, Mich., now out of business, has been changed back to the Flanders Electric Co., and the headquarters have been moved back to Pontiac from the Dime Savings Bank Building in Detroit.

The new Flanders company includes, besides E. Leroy Pelletier, Morris Rothschild, of the Harris Brothers Co. The low-priced electric is still in preparation, but it has not been definitely decided whether this machine will be marketed under the Flanders name or by a separate concern.

DENVER, COL., March 19.—The Denver automobile show, which was to have been held on March 30, will not be held, owing to the withdrawal of several dealers scheduled to exhibit.

Takes Over Thurber Starter Manufacture

DETROIT, MICH., March 19.—The Northern Engineering Works has undertaken the manufacture and sale of the Thurber rotary starter and the business of the Thurber Rotary Starter Co. will be handled by it through its Thurber rotary starter department

NEWARK, N. J., March 19—The A. Elliott Ranney Co., New York City distributor of the Hudson car, has turned over the local agency for that car to the Foley M. C. Co. This agency will be under the supervision of W. H. Barley. The agency covers the whole of Essex County. It will remain at 37 William street.

Goodyear Makes Truck Tire Changes

AKRON, OHIO, March 20.—The solid demountable tire has been changed from round to flat tread. Experience has shown that this change supplies more road contact and greater consequent traction, often enabling trucks to get themselves more easily out of trying situations. The side-flange detachable, made in sizes 4 inch and under, will be a higher tire in 1914, giving more wearing rubber than ever before. This tire has also been changed from round to flat tread. The cushion demountable, formerly for fire department use, is now offered the trade generally for service where high speed and trying conditions, quick stopping and starting are necessary. The individual block tire is unchanged.

New York Orphans' Outing, June 4

NEW YORK CITY, March 21.—At a meeting of the Orphans' Automobile Day Assn. of New York, Inc., held yesterday at the offices of the National Automobile Chamber of Commerce, new officers were elected and a general discussion of the plans for entertaining 5,000 children this summer was heard. W. C. Poertner was elected president; W. J. Morgan, first vice-president; G. H. Robertson, second vice-president; H. A. Bonnell, treasurer, and A. L. Prindle, secretary. It was decided that the outing will take place on Thursday, June 4. No definite decision was reached as to where the outing would take place. This will probably come up at the next meeting on March 27.

Benjamin to Manage Fiat Sales

NEW YORK CITY, March 25—C. Arthur Benjamin has been appointed manager of sales for the Fiat Automobile Co., Poughkeepsie, N. Y., with headquarters in that city. His work will embrace the entire country. H. T. Clinton, who has been with the Fiat company, will work the territory from Chicago east under Mr. Benjamin. Mr. Benjamin has had a long connection with the motor industry, and was sales manager of the Alco company until it discontinued its motor business last year, and since that time he has been engaged in closing up the Alco affairs and looking after their service headquarters.

Creditors Sue Schacht Stockholders

CINCINNATI, OHIO, March 21.—Attorney E. H. Brink, representing the United States Tire Co. and other creditors of the Schacht Motor Car Co., now in the hands of John F. Dietz, receiver, brought suit to-day to assess the stockholders of the concern for the unpaid subscriptions alleged to be due on their holdings. This money is sought to satisfy the claims of the creditors, who thus far have secured 60 per cent. of their discounts, it is alleged. The total liabilities of the company were approximately $140,000, so that a balance of about $56,000 remains on merchandise accounts.

Factory Miscellany

DOMINION Car Plant in Coldbrook—A recent issue of the St. John *Standard* says: Despite statements which have been made to the contrary, the recently organized Dominion Motor Car Co. will take steps to erect a plant at Coldbrook and assemble cars, and it is the intention of the promoters of this company to be operating in the city within a comparatively short time. Organization meetings have been held in New York, where noted capitalists are interested in the project, and they have not departed from their original intention of having St. John as their manufacturing and distributing centre for Canada. Several local men, it is said, are interested in this newly organized concern, and they report that remarkable success has been met with during recent meetings of the promoters in New York. It was said yesterday by one familiar with the workings of the company, that model cars had already been constructed, and were now running in New York under the name of the Dominion car, and have been much admired, having been constructed under the personal instruction of Montague Roberts, the famous automobile engineer. It is understood the parts of these cars to be turned out in the city will be imported from England, which it is considered will effect a considerable saving. This will enable the company to sell at a more moderate price than the cars in which the parts are imported from the United States.

Rutenber Co. Building—The Rutenber Co., Berlin, Ont., is building a factory for the manufacture of automobile engines.

Canadian Tractor Plant Completed—Marshall's Sons & Co., tractor manufacturers, of Gainsboro, England, have completed their factory at Saskatoon, Sask.

Universal Tire Establishes Plant—The Universal Tire Co., Los Angeles, Cal., has purchased the Dryfus Winery at Anaheim for the purpose of establishing an automobile tire factory.

Phoenix Co. May Build—It is reported that the Phoenix Mfg. Co., Eau Claire, Wis., will build a factory for manufacturing tractors and gas-electric engines. J. S. MacDonald is interested.

Mansfield Addition Completed—The brick work on the three-story addition to the plant of the Mansfield Tire & Rubber Co., Mansfield. O., has been completed and will soon be ready for occupancy.

Falls Rubber's New Location—Although no definite action has been taken, it was announced recently that the Falls Rubber Co., Cuyahoga Falls. O., probably would move its plant to Cleveland this spring. No reason for the change.

Briggs Co. Acquires New Plant—The Briggs Mfg. Co., Detroit, Mich., automobile body manufacturers, has acquired the large plant formerly occupied by the A. C. Knapp Trimming Co. It is three stories high and 200 by 210 feet.

Purchases Franz Body Plant—The abandoned plant of the Franz Body Co., Akron, O., formerly used for the manufacture of automobile bodies, has been purchased by Frank Celzer, who will operate a rubber goods plant in the buildings.

Carbon Co. Secures Site—The Howard Carbon Co., Toledo. O., which was incorporated recently with a capital of $50 000, has secured a site for a factory which will manufacture brushes to be used in electrical systems for automobiles.

McNaull Will Build—The McNaull Auto Tire Co., Toledo, O., which has filed papers increasing its capital stock from $75 000 to $175 000, is arranging to erect a large tire plant in Toledo. The company has offices at 630 Ohio Building. W. D. McNaull is the patentee of the products to be manufactured.

Panama Rubber Factory Finished—At a meeting of the Panama Rubber Co. at Compton, Cal., during the past week it was decided to establish uptown offices in Los Angeles, Cal., in the new building of the W. D. Newerf Rubber Co. The factory of this company at Compton is now completed and machinery is being installed.

Takes Over Owen Plant—The announcement is made that the Springfield Spring Co., Springfield, O., has taken over the former plant of the Owen Machine Co., which will be remodeled into a plant for the manufacture of all kinds of springs. The capitalization of the company was recently increased from $35,000 to $60,000.

Courtesy Department Helps—At the Detroit plants of the Studebaker Corp. there is a courtesy department which devotes its energies to entertaining visitors and showing them through the plants. Many Studebaker dealers make use of this department in their selling campaign by commending to it prospective buyers who may visit Detroit.

Industry Requires Large Sum—Lancaster, Pa., has offered the Midgley Tire & Rubber Co. a plant site and $100,000 to locate in that city. The $100,000 required is not a bonus, but is to be paid for common stock of the company. It is said that the industry would employ 200 men from the start and this number would be increased to between 500 and 800 as rapidly as the business could be developed.

Dayton Rubber Adds Machinery—A complete reorganization of the Dayton Rubber Mfg. Co., Dayton, O., will be effected following the increase of the authorized capital from $150,000 to $1,000,000. The increase in capital was made for the purpose of providing additional machinery. E. P. Hooven was elected president; J. C. Hooven, vice-president; E. C. Hooven. secretary-treasurer, and John A. McMillan, general manager.

Canadian Products Buy Plant—The Canadian Products, Ltd., Guelph, Ont., has purchased the plant of the Standard Fitting and Valve Co., on the York road, which has been lying idle for some time. The president of the new company is W. B. Hinman, of Cleveland, O., and he is associated with a number of business men of that city. The new company has been incorporated with a capitalization of $100,000. It will manufacture high carbon steel structural tubing. New machinery has been ordered.

Walker Starter Purchases Land—The Walker Starter Co., of Laporte, Ind., has just purchased the property in which it has been operating, which includes two lots and buildings on Monroe street, Laporte. The company is capitalized at $30,000, and its officers are: Frank H. Walker, president and manager and inventor of the device; Ed. L. Walker, vice-president; W. K. Loughborough, secretary and treasurer, and Dwight L. Loughborough. sales manager. The company manufactures starters for automobiles, traction engines and stationary engines.

The Automobile Calendar

Mar. 30-Apr. 4	Newark, O., Automobile Show.
March 31	New York City, S. A. E., Electric Vehicle Division Meeting.
April 1-4	Elgin, Ill., Automobile Show, Elgin Auto Dealers' Assn.
April 7, 8, 9	New York City, S. A. E., Standards Committee Meeting.
April 8-11	York, Pa., Automobile Show, Coliseum.
April 9-15	Manchester, N. H., Automobile Show.
April 12-19	Prague, Austria, Eleventh Annual International Auto Exhibition, Royal Tiergarten.
April 21	New York City, S. A. E., Research Division Meeting.
May 5	New York City, S. A. E., Electrical Equipment Division Meeting.
May 12	New York City, S. A. E., Ball and Roller Bearings Division Meeting.
May 14	New York City, S. A. E., Motor Testing Division Meeting.
May 25-26	Palermo, Sicily, Targa Florio, 700-Mile Race.
May 30	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 1	Palermo, Sicily, Coupe Florio, 279-Mile Race.
June 18	Uniontown, Pa., Hill Climb, Auto Club of Fayette Co.
June 23-26	S. A. E. Summer Meeting, Cape May, N. J., Cape May Hotel.
June 24-26	Chicago, Ill., Seventh Annual Meeting of Nat. Gas Engine Assn.
June 30	London, Eng., Fourth International Rubber and Allied Industries Congress.
July 3-4	Tacoma, Wash., Road Races, Tacoma Carnival Assn.
July 4	Sioux City, Iowa, 300-Mile Race, Sioux City Auto Club and Speedway Assn.
July 4	Lyons, France, French Grand Prix.
July 13-14	Seattle, Wash., Track Races, Seattle Speedway Assn.
July 25-26	Belgium Grand Prix Road Races.
Aug. 28-29	Chicago, Ill., Elgin Road Races, Chicago Automobile Club.
Sept. 9	Corona, Cal., Road Race, Corona Auto Assn.
Sept. 26-Oct. 6	Berlin, Germany, Automobile Show.
Oct. 1	Paris, France, Kerosene Motor Competition.
Oct. 19-26	Atlanta, Ga., American Road Congress of the American Highway Assn. and the A. A. A.
November	El Paso, Tex., Phoenix Road Race, El Paso Auto Club.
November 8-11	Shreveport, La., Track Meet, Shreveport Auto Club.

The Week in the Industry

Motor Men in New Roles

JEWELL Marion Sales Representative—W. S. Jewell has been appointed Eastern sales representative for the Marion M. C. Co., Indianapolis, Ind. The territory over which he has supervision includes all of New England and portions of New York, New Jersey and Pennsylvania.

Price Transferred—H. A. Price, for several years in charge of the B. F. Goodrich branch at Atlanta, Ga., has been made manager of the Cleveland, O., branch.

Cole Ferro Advertising Manager—Roland Cole, lately connected with Yawman & Erbe at Rochester, N. Y., has joined the Ferro Machine & Foundry Co., Cleveland, O., as advertising manager.

Warner Succeeds Eccleston—Announcement is made of the appointment of Fred. W. Warner as general sales manager of the Oakland Motor Car Co., Pontiac, Mich., to succeed J. B. Eccleston, who has resigned.

Boyden with Battery Co.—Charles Boyden, who was formerly chief engineer of the American Motors Co., Indianapolis, Ind., has associated in a similar capacity with the Electrical Engineering and Storage Battery Co., Sandy Hook, Conn.

Hetzell with Knight Tire—A. S. Hetzell has returned to Cleveland, O., as manager of the local branch of the Knight Tire Co., having resigned his position with the B. F. Goodrich Co., with whom he was associated many years.

Danaher with Overland—G. S. Dănher, who recently resigned as vice-president of the Southern Motors Co., has been appointed special representative of the Willys-Overland Co., Toledo, O., for the southern territory, with Birmingham, Ala., as headquarters.

Voit Diamond Coast Manager—W. J. Voit, former Los Angeles, Cal., manager of the Diamond Rubber Co., and recent San Francisco sales manager for this company, is to succeed C. E. Mathewson as Pacific Coast manager. Mr. Mathewson recently resigned to go into business for himself.

Dean Joins Chevrolet—P. P. Dean, formerly engineer for the Diehl Mfg. Co., has joined the Chevrolet Motor Co., of New York, in the capacity of manager of New York sales, with a showroom at Fifty-first street and Broadway. Mr. Dean is a member of the American Society of Mechanical Engineers and Society of Automobile Engineers.

Stoops Resigns—Harry J. Stoops, vice-president and general manager of the American Cyclecar Co., Bridgeport, Conn., which company he organized more than a year ago, has resigned, and will shortly sever his connection with that company. Mr. Stoops is one of the early pioneers, having designed one of the first cyclecars in America.

Tucker Resigns—Richard E. Tucker, for several seasons advertising manager of the Frederick E. Murphy Automobile Co., Minneapolis, Minn., distributor for the Lozier, Mitchell, Paige and Commerce lines, has resigned, effective April 1. He will become advertising manager for the Edmund G. Walton agency, real estate, 114 South Fourth street, Minneapolis.

Hase Passes Away—Charles F. Hase of Milwaukee died Tuesday, March 17, after an illness of a few days. Mr. Hase was formerly treasurer of the A. O. Smith Co., Milwaukee, Wis., but sold his interest a few years ago at the time of a reorganization of the company. Mr. Hase was forty-four years of age, and until within a week before his death was in the prime of health.

Smith Heads Kelly-Springfield Tire—H. Lee Smith, who has been in the rubber business for 9 years this week took charge of the St. Louis, Mo., branch of the Kelly-Springfield Tire Co., vice W. L. Warden, who has been in charge since the death of Manager John D. Lindsey, about 10 days ago. Smith had been Indiana representative of the Kelly-Springfield Co. Warden will return to the Cleveland office of the company, from where he came to take temporary charge of the local branch.

W. H. Pirrong Dead—W. H. Pirrong, for many years a prominent figure in the bicycle and automobile industry, died at his home in Lakewood, O., on March 19, after a very brief illness. Mr. Pirrong was one of the first men in the country to appreciate the possibilities of electric welding, and out of his pioneering in this field grew the Standard Welding Co., Cleveland, O. He was sales manager of that company from the time of its organization until his retirement from active business, immediately following the death of W. S. Gorton, former secretary and general manager of the company.

Garage and Dealers' Field

Quigley Resigns Managership—Chas. A. Quigley, manager of the Salt Lake City, Utah, branch of the Studebaker Corp., has resigned and has taken a distributing contract for the Studebaker automobile line, embracing that entire region. Mr. Quigley has been in the Studebaker service for more than 20 years.

Recent Changes in Washington—Probey-Haynes Motor Co., agent for the Haynes and Davis in Washington, D. C., will remove from 1230 Wisconsin avenue to larger quarters at 1223 New York avenue. The Locomobile branch, on Connecticut avenue, is being rebuilt. The Selby Co., Paige-Detroit agent, has removed to 1805 Fourteenth street, N. W.

Takes Over Houck Agency—The Wilson & Williard Mfg. Co., manufacturer of oil well machinery in Los Angeles, has taken over the agency for the Houk wire automobile wheel for the State of California, and has opened a salesroom at 1046 South Olive Street, and will be under the management of C. A. Friedmann.

La Tour Ohio Chauffeur Examiner—The Secretary of State, Chas. H. Graves, has appointed J. A. La Tour examiner of chauffeurs for the northern Ohio district. Mr. La Tour will hold examinations at 2364 Euclid avenue, Cleveland, from 1.30 to 5.30 daily. The State law requires each applicant for a chauffeur's license to be familiar with the local and State automobile regulations.

Mexicans Charging Heavy Duty—The Constitutionalists of Mexico, who hold the entrance port of Naco, Ariz., have ordered that a duty of $600 Mexican money be imposed on all automobiles going from the United States into the State of Sonora, through this port. The duty is forcing parties bound for Cananea and other parts of Sonora to change cars at the border instead of going on across the line and paying the tax.

Dallas Good Automobile District—The Automobile Tire Company, New York City, has opened up a new branch at 2032 Commerce Street, Dallas, Tex., with Robert Clausius as manager. Ed. C. Griffith, president of the concern, who has just returned from a Western tour, states that Dallas is, without question, the greatest distributing point in the Southwest for automobile and allied industries.

Big Shipment of Stutz—One of the sensations of the motor show week in Boston was the shipment of a trainload of Stutz cars to the Stutz Motor Car Co., of Boston. There were forty machines divided between roadsters and touring cars, and it took fifteen freight cars to bring them to Boston. The shipment represented $100,000, and a number of the cars were sold right out of the train.

Stegeman Places Big Order—The Stegeman Motor Car Co., 606 Linus street, Milwaukee, Wis., has just booked one of the largest contracts it has ever undertaken. The order is for fifty Stegeman trucks in 1 and 3-ton sizes for the Public Service Express Co. of New York, which handles deliveries for 12 of the largest department stores in the metropolis. The order amounts to about $75,000. The trucks will be used for hauls to clearing house stations in various parts of New York.

New Process for Making Bolts—A new process for making bolts for automobile springs has been developed by the Corcoran-Seidel Co., Cleveland, O. Instead of welding or turning the heads of the bolts, "cold-upsetting" machines have been built, which shape the heads on cold bar steel. The method is said to be much less expensive than either of the two processes heretofore employed. The plant will have a capacity of 25,000 bolts a day. Orders have been booked for eleven months' output.

Paine in New Capacity—H. M. Paine, former president of the Paine Automobile Co., has become general superintendent of the garage and service station of the General Motors Truck Co. The company maintains the largest joint gasoline and electric truck service station in St. Louis. Paine is well known in the local automobile field, being connected with the Halsey Automobile Co. when it was one of the few in St. Louis. J. W. Underwood, former general manager, has taken charge as manager of the Warren Garage and Rental Co.'s garage.

Accessories for the Automobilist

THE CALCULAGRAPH—A time-keeping instrument, Fig. 1, of interest to both the factory man and the garage proprietor that desires to keep an accurate record of the time spent by the workman on each job is made by the Calculagraph Co., 9 Maiden Lane, New York City. This instrument will stamp the time the work was commenced and also the time spent in completing it. All the workman is required to do is to make out a card, Fig. 2 when he starts a new job, insert it in the clock and pull the stamping lever. When the job is finished, he puts the card in the clock again and the elapsed time is automatically recorded.

The advantages claimed for this clock are that it saves a large part of the workman's time in making out time slips, that it gives greater accuracy and that it saves the time of the bookkeeper, as no subtracting of the time of starting and finishing is necessary.

The Calculagraph has three dials, as will be noted in the figure. The right one shows the time the work was commenced and the other two the time employed, the left one indicating the hours and the center one the tenths. When the card is inserted into the machine the handle is pulled in one direction and this stamps the starting time and also the figures of the other two dials. When the work is finished the handle is moved in the other direction and this stamps the two arrows indicating hours and tenths on the card. Each arrow and its dial rotate together. The Calculagraph can be obtained with date-printing attachment if desired.

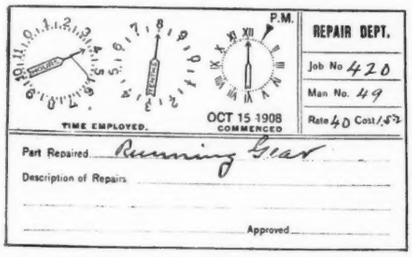

Fig. 2—Time card stamped by Calculagraph. The commencing time is shown at the right and the time employed at the left

Fig. 1—Stamping time card in Calculagraph

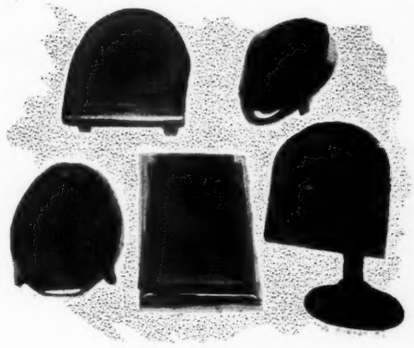

Fig. 3—Auto pedal pads

Nurinkle Steam Vulcanizer—The latest development in portable vulcanizers has been made by the R. E. Stevenson Co., Muncie, Ind. This concern is manufacturing an ingenious steam vulcanizer, in which the heat is generated by burning gasoline. The vulcanizer can be used either on tubes or casings. It is divided into two compartments, the one adjacent to the tire being filled with water and the other one with gasoline. As the gasoline is consumed the water is heated and finally turned into steam, the heat of which vulcanizes the tire. A measured quantity of fuel is used so that there is no danger of overcuring the tire, the heat being just sufficient to vulcanize it properly. There is a safety valve on the water chamber which maintains the steam at a uniform pressure.

Troy Trailer—A trailer designed for use in connection with motor trucks has recently been put on the market by the Troy Wagon Works Co., Troy, O. This concern has manufactured trailers for use behind steam tractors for the past 8 years.

The Troy trailer, Fig. 4, is very strongly constructed. The frame is made out of heavy channel steel, half-elliptic springs are used all around, the axles are of I-beam section and the wheels are of heavy artillery design, with steel rims. Roller bearings are employed in the wheels and bronze bushings are used on all close bearings. All four wheels are used in steering.

Of special interest is the draw bar and steering construction. The design being such that a train of trailers will follow in the path of the tractor under all conditions. The draw bar is connected to the main frame of the tractor and not to the axles, the draw bar being telescopic in form and containing a coil spring that absorbs the shocks that would otherwise be transmitted to the tractor. This spring starts to compress when a pressure of 200 pounds is imposed on it and is completely compressed at 2,000 pounds.

The draw-bar is pivoted to a cross-member of the frame and is also attached to the tie rod of the steering gear so that the movement of the draw-bar to the right or the left turns the wheels.

The capacity is from 2 to 5 tons, the weight of the chassis is 3,330 pounds, the clearance 17 inches, the height of the frame above the ground when empty 2 feet 10.5 inches, and the price of the chassis $1,000.

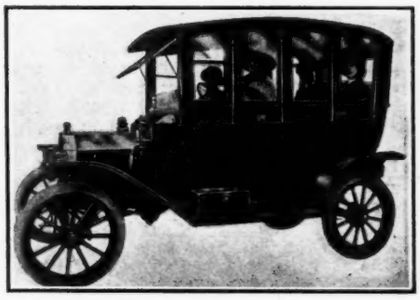

Fig. 5—Mandel Limosette for Fords

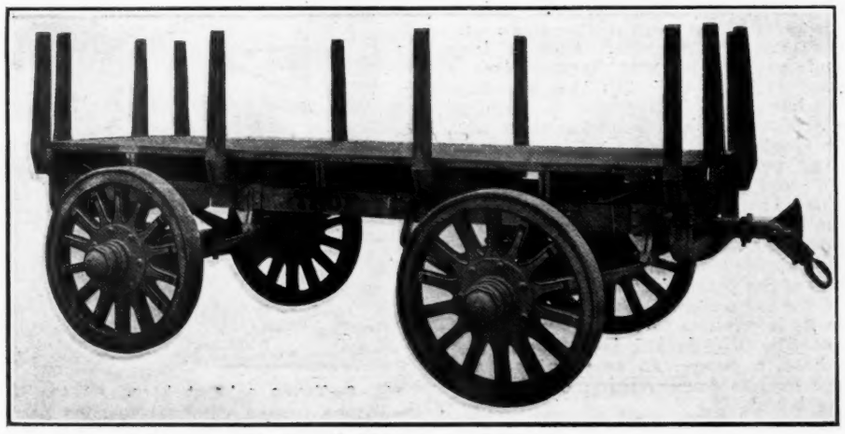

Fig. 4—Troy trailer with stake body and steel-tired wheels

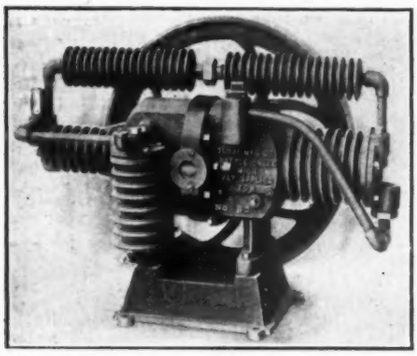

Fig. 6—Globe air-compressor for garage work

Mandel Limosette for Fords—A detachable limousine top, Fig. 5, for Ford cars exclusively, one that adds only 75 pounds to the weight of the car after removing the top and windshield is made by the Mandel Limousine Co., 1455 W. Congress St., Chicago, Ill. It sells for $150 and can easily be installed without any special tools, as it bolts to the old top irons.

The doors of the Limosette are of sufficient height to allow easy entrance and exit, and swing with the Ford doors. Brass trimmings are used and the windows are set in mahogany frames. The interior is finished in broadcloth and an electric dome light is provided.

Globe Air Compressors—A full line of air compressors for garages is made by the Globe Manufacturing Co., Battle Creek, Mich. These compressors are air-cooled and operate on the two-stage principle, an air cooled inter-cooler being arranged between the high and low-pressure cylinders. The two cylinders are opposed to insure smooth running.

A feature of these compressors is that they only require oiling once in 60 days. All working parts are inclosed, and the bearings are readily accessible and adjustable. The pistons are cast in one piece, insuring perfect alignment. Three metal rings are used on each piston. The valves are made of bronze and hardened tool steel, and are interchangeable. A safety valve is provided for emergencies.

All compressors except the smallest are provided with an air-cooled trap that collects any moisture or oil that may be present in the discharge air.

One of these compressors, the Type B, is illustrated in Fig. 6.

Globe Dead Easy Tire Pump—As its name implies, the Globe Dead Easy pump, Fig. 7, will easily inflate a tire. This is accomplished by using a two-stage construction in conjunction with a long hand lever. The long handle gives a large leverage and with the two-stage principle much less power is required to produce a given pressure than with the single-stage type.

The bores of the two cylinders are 1.625 and 3.5 inches. The pistons are actuated by a rocker arm, the connecting-rods being connected to the ends of this arm. Ball valves are used.

With the lever detached, the dimensions of the pump are 5 by 8.5 by 9 inches and the net weight is 13 pounds. Therefore it is possible to carry it in the tool box. The price is $15, including 12 feet of hose, a gauge, an acorn nipple and hand clamps for installing on the running board.

Wixon Six-Cylinder Manifold—Claiming that the overlapping of the suction impulses in a six-cylinder motor causes some cylinders to get more fuel than others, the Imperial Brass Mfg. Co., Chicago, has brought out a manifold for sixes which is said to cause to be fed to each cylinder, the proper amount of fuel and that one cylinder will not rob another.

The manifold is of the Y type, each arm of the Y feeding to three cylinders, as shown in Fig. 8, and a separate throttle controlling each set of three cylinders. The throttles operate simultaneously, but since none of the first three cylinders overlap it is claimed each cylinder will receive the proper amount of mixture. In this way a smoother running, and more powerful motor is obtained, the maker states. The manifold was designed by H. H. Wixon of the Imperial Brass Co., which now is in a position to furnish the manifold for both old and new cars.

Tremo Exhaust Horn—An interesting improvement in exhaust horn construction has been adopted by the maker of the Tremo exhaust horn, the D. Henry Bonner Co., Inc., Cambridge, Mass. This is a universal coupling, known as the Warren, that enables the horn to be attached to any size exhaust pipe without special fitting. This coupling, Fig. 9, is shown contracted in the top view and expanded in the middle view. As will be noted from these illustrations, the coupling can be attached to any exhaust pipe by the use of a hammer and a monkey wrench. It can be expanded to more than two inches and contracted to less than one inch.

The Tremo horn is shown at the bottom of the figure. It is designed to give

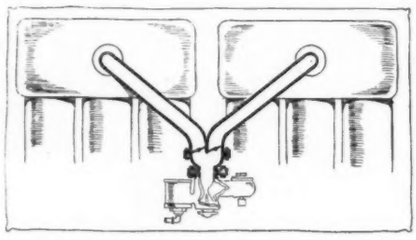

Fig. 8—Wixon six-cylinder manifold

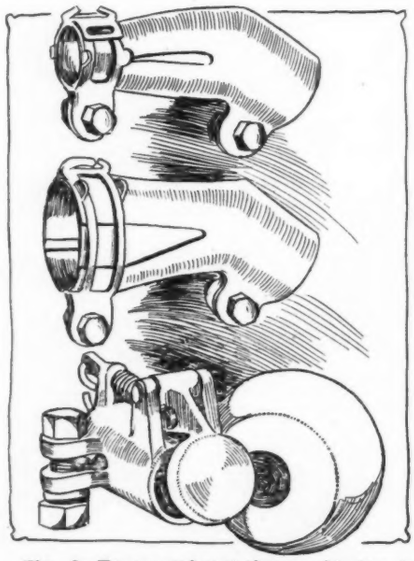

Fig. 9—Tremo exhaust horn. At top is shown the Warren universal coupling used on the Tremo. The horn is shown at the bottom

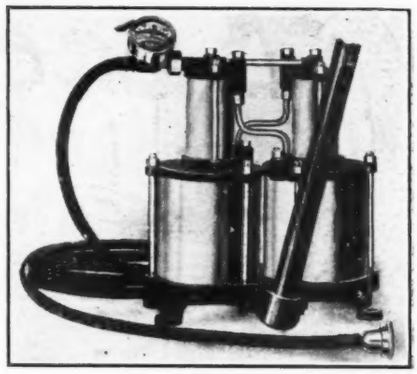

Fig. 7—Globe Dead Easy tire pump

a warning that is penetrating yet is not liable to confuse or frighten pedestrians. The construction is such that the exhaust gases have a clear passageway. Five sizes of horns are made: A Ford horn, selling for $4; and four others for cars varying in horsepower from 16 to 50 and above, the corresponding prices ranging from $6 to $7.50.

Pyrma Aluminum Matting—Aluminum matting is manufactured by the Metallic Automobile Matting Co., Rochester, N. Y. It is made in widths varying from 9 to 20 inches in rolls 50 feet long, and in widths from 24 to 36 inches in rolls 24 feet long. It is easily applied, as it can be cut with a tinner's snips or with an ordinary pair of shears. Aluminum moulding or binding is also made by this concern and is furnished in 10 and 14-foot lengths.

Auto Pedal Pads—With a view to increasing the safety of car operation by reducing the possibility of the feet slipping from the pedals the Auto Pedal Pad Co., 794 Seventh avenue, New York City, is making rubber faced pedal pads, Fig. 3, in all sizes and shapes, that can readily be applied to any make of car. The upper surface of the rubber is corrugated to give the foot a good grip and the rubber is held in a metal frame that is attached to the pedal by means of prongs.

Colstad Tire Pump—The Colstad Mechanical Laboratories, Atlantic, Mass., is marketing a motor-driven tire pump for Ford cars which is claimed to inflate them to a pressure of 55 pounds in 3½ minutes. The pump is a small single cylinder air-cooled one, with cylinder ¾-inch bore by 1⅛-inch stroke. The pump is designed to go on the front end of the motor in place of the fan bracket, and in installing it it is necessary to take off the present fan, shaft and bracket, and after drilling one 5-16-inch hole in the inside of the fan pulley, according to the template furnished, the fan is mounted in the correct position on the pump shaft and the entire assembly bolted to the motor. To place the pump in action it is but necessary to pull a small lever until the eccentric which drives the pump meshes with the fan pulley.

Security Spring Spreader—A simple stirrup-shaped spring divider intended to separate the leaves in a spring in order to place oil between them has been brought out by the Security Reliner Co., Montgomery, N. Y. The Spreader is a steel band bent into stirrup form with pointed edges to be inserted between the spring leaves and a thumbscrew for inserting these edges as desired to separate the spring. It lists at $1.50.